Original Article

# Clinico-epidemiological profile and outcome of snakebite patients presented to a teaching institute – A descriptive retrospective review

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## Abstract

**Introduction:** Snakebites are a significant cause of morbidity and mortality in India despite availability of anti-snake venom and the absence of a large number of highly venomous snakes. This may be attributed to treatment seeking behaviour of the population. The study aims to find out common clinical features, outcome, and delay in arrival time to the hospital in snakebite cases. **Materials and Methods:** This is a cross-sectional retrospective record-based study among the patients presented with a history of snakebites to the Basaveshwara Medical College Hospital and Research Centre, Chitradurga, conducted from 1 January 2019 to 31 January 2021. **Results:** Out of the 96 patients, the majority of snakebite victims were male and of an age group of 21–30 years. The most common site for snakebite was the lower limb, and about 57.2% of patients had visible fang marks. Among snake species identified, the most common was krait bites, followed by cobra bites. Neurotoxic envenomation manifestation and severe presentation were found in almost half (53.1%) of the cases. Almost half of the patients took 1–4 hours to arrive at the health facility. Surprisingly, only 35% cases arrived to the health care facility within an hour of snakebite. Most of the patients (82%) recovered with the treatment with very minimal fatality/mortality. **Conclusion and Recommendations:** Although half of the patients presented with severe forms, only 35% of the patients arrived within an hour to the health care facility. This indicates the need for an information dissemination system to avoid severe disease as well as to prevent mortality.

**Keywords:** Envenomation, outcome, snakebite

## Introduction

Snakebites are a significant cause of morbidity and mortality worldwide, especially in tropical countries. One nationally representative mortality study showed that India had 1.2 million snakebite deaths (average 58,000/year) from 2000 to 2019 and about 70% occurred in eight higher burden states only.[1] Ironically, this occurred although there was no shortage of anti-snake venom (ASV) and the absence of a large number of highly venomous snakes in India. This high mortality rate is often due to delays in seeking appropriate medical treatment as many people in rural areas still rely on traditional remedies and witchcraft instead of seeking prompt medical attention from hospitals.[2]

Envenomation from snakebites can have severe effects on various organ systems, including the central nervous system, kidneys, heart, blood coagulation, and local tissues at the bite site.[3-5] Snakebites are typically considered a rural problem associated with environmental and occupational factors.[6] In this study, we aim to investigate the arrival times, clinical features, complications, and outcomes of

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snakebite cases seen in the casualty department of a tertiary care hospital in the Chitradurga region of India.

## Objectives

1. To evaluate the clinical features and time delay in seeking treatment in cases of snake bites.
2. To assess the complications and outcomes of snakebites seen in the emergency medicine department of a tertiary care hospital.

## Materials and Methods

This is a retrospective, observational, descriptive study based on the medical records of the patients presented with a history of snakebites to the Basaveshwara Medical College Hospital and Research Centre (BMCH&RC), Chitradurga casualty department. A structured data collection form was developed to record demographic and clinical details of patients hospitalised at BMCH and RC between 1 January 2019 and 31 January 2021.[7] Ethical clearance was obtained from the Institutional Ethical Committee.

### Inclusion criteria

All patients of any age and either gender admitted in BMCH&RC, Chitradurga, between January 2019 and January 2021 with a history of bites by snakes.

### Exclusion criteria

Incomplete or missing data in medical records.

### Selection of patient records and data collection

Medical records of patients who presented to the casualty department with a history of snakebites were shortlisted for the study. Patients with incomplete or missing data in medical records and those who left against medical advice were excluded from the patient record selection process. A standardised data collection form was designed to facilitate the data collection process from the medical records. Patient demographics, type of snake, site of snakebite, time of snakebite, time of presenting to the hospital, local symptoms, symptoms according to different types of venom toxicity (i.e., myotoxicity, hemotoxicity, neurotoxicity), and outcomes of patients were documented in the data collection form by referring to the Casualty Department log book and the complete medical records of the patients.

### Grading of envenomation

Envenomation was categorised into mild, moderate, and severe based on clinical signs.[8]

| Grading of envenomation | Clinical signs |
|---|---|
| Mild | Limb swelling of <4 cm with no clinical evidence of local gangrene or systemic symptoms |
| Moderate | Local swelling of 4 cm or more and/or clinical evidence of local gangrene with minimal or no systemic symptoms |
| Severe | Appearance of fatal clinical signs of systemic poisoning |

**Flow Chart of the Study Design**

Selection of Patients and Data Collection
↓ Data collection forms
Frequency of snakebites according to age group
↓
Type of snake, time of bite, and site of bite
↓
Time elapsed and clinical severity
↓
Local symptoms
[Fang marks, infected wound, gangrene, skin discoloration, others]
↓
Symptoms according to types of toxicity
[Myotoxicity - muscle tenderness, myoglobinuria; hemotoxicity - coagulopathy, hematemesis, hematuria, thrombocytopenia; neurotoxicity - numbness, ventilated, paralysis of facial muscles, respiratory failure]
↓
Outcome
(Fatal, permanent impairement/damage, recoverd)

The final outcomes considered in this study were complete recovery, death, and patients who left against medical advice.

Results are expressed as frequencies and percentages. All analyses are performed using IBM SPSS version 27 and Microsoft Excel 365. The continuous variables are presented as means with standard deviations or medians with inter-quartile ranges depending upon underlying distribution. The categorical variables are presented as percentages for each category. The statistical association of each variable was assessed by Student's t-tests, Mann–Whitney U tests, and Chi square tests as appropriate. A probability of $P < 0.05$ was considered statistically significant.

## Results

A total number of 96 patients with a history of snakebites which satisfied the inclusion criteria were included in the study ($n = 96$).

### Patient demographics

Out of the 96 included patients, the majority of snakebite victims were aged between 21 and 30 years ($n = 27$; 28.1%) [Figure 1]. The youngest victim was 4 years old, and the oldest victim was 78 years old. Male patients out-numbered female patients in a ratio of 7:3.

The usual time of snakebites was evening, that is, from 18:00 to 23:59 hours (45 cases) [Figure 2].

### Snake species and envenomation

Among the snake species identified, cobra bites accounted for 15 cases (15.6%), viper bites for 10 cases (10.4%), and krait bites for 30 cases (31.2%). The snake species was unknown in 41 cases (42.7%). The severity of envenomation varied among the different snake species, with the majority of patients presenting with severe envenomation for cobras (9 out of 15), vipers (3 out of 10), and kraits (20 out of 30). For cases where the snake species was unknown, 16 cases had severe envenomation, 8 had moderate envenomation, and 17 had mild envenomation [Table 1].

About 50% of total cases presented with symptoms of severe envenomation, of which 41 victims were administered ASV as per National Snakebite Management Protocol of Government of India.[9]

## Site of snakebite

The lower limbs were the most common site of snakebite, accounting for 78 cases (81.2%), followed by the upper limbs in 10 cases (10.4%) and the head and face area in 5 cases (5.2%) [Figure 3]. The remaining 3 cases (3.12%) had snakebite on other parts of the body [Figure 3].

## Local presentation

The study found that out of 96 snakebite cases, only 57.2% of patients had visible fang marks, while 8.3% of patients had an infected wound and 2% developed gangrene. Skin discoloration was observed in 28.1% of patients, and 2% presented with other symptoms such as cellulitis and blistering [Table 2].

## Envenomation manifestations

Neurotoxic manifestations were the most common envenomation manifestations, reported in 51 cases (53.1%), closely followed by hemotoxic manifestations in 42 (43.8%) cases. The myotoxic manifestations were observed in the least number of cases, that is, only 3 cases (3.1%). The specific symptoms reported by patients are presented in Table 3.

## Hospital arrival time

In terms of hospital arrival time, 18 victims (18.5%) arrived at the hospital within an hour of the snakebite, 26 cases (27.08%) reached the hospital in 1–4 hours, 5 cases (5.2%) arrived in

**Table 1: Snake envenomation**

| Snake species involved | Mild | Moderate | Severe | Total | Chi-square test |
|---|---|---|---|---|---|
| Cobra | 4 | 2 | 9 | 15 (15.6%) | *P*-0.068 |
| Krait | 5 | 5 | 20 | 30 (31.2%) | |
| Viper | 3 | 4 | 3 | 10 (10.4%) | |
| Unknown | 17 | 8 | 16 | 41 (42.7%) | |
| Total | 29 (30.2%) | 19 (19.8%) | 48 (50%) | 96 (100%) | |

**Table 2: Local manifestations**

| Local symptoms | No. of cases (*n*=96) | Percentage |
|---|---|---|
| Fang marks | 55 | 57.2 |
| Infected wound | 08 | 8.3 |
| Gangrene | 02 | 2 |
| Skin discoloration | 27 | 28.1 |
| Others (cellulitis, blistering, etc) | 04 | 4.1 |

**Table 3: Envenomation manifestations**

| Venom Toxicity | Manifestations | Frequency (%) |
|---|---|---|
| a) Myotoxicity (*n*=3) | Muscle tenderness | 02 (2.08%) |
| | Myoglobinuria | 01 (1%) |
| b) Hemotoxicity (*n*=42) | Coagulopathy | 14 (14.45%) |
| | Hematuria | 08 (8.3%) |
| | Hematemisis | 08 (8.3%) |
| | Thrombocytopenia | 12 (12.5%) |
| c) Neurotoxicity (*n*=51) | Numbness | 06 (6.2%) |
| | Ventilated | 19 (19.7%) |
| | Respiratory failure | 14 (14.8%) |
| | Ptosis | 11 (11.4%) |

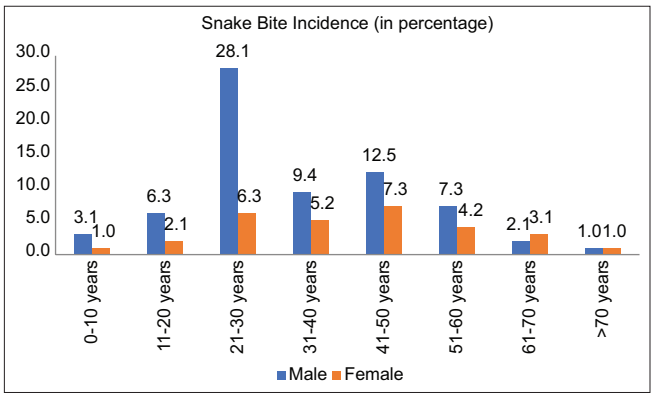


**Figure 1:** Frequency of snakebite cases according to age and sex

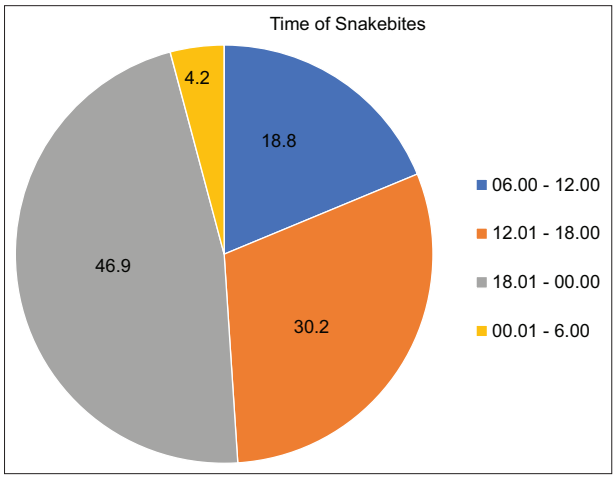


**Figure 2:** Frequency of snakebite cases according to time period

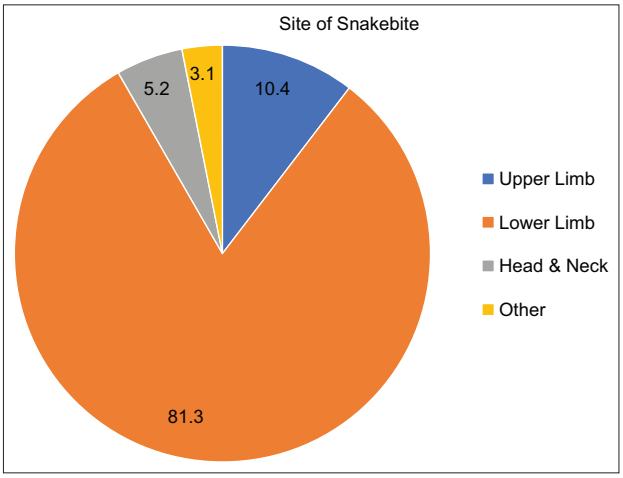


**Figure 3:** Site of snakebite

4–24 hours, and 2 cases (2%) took more than 1 day to seek medical care. Additionally, 45 cases (46.8%) were referred from other health care setups [Table 4]. The patients were referred in cases with shock not responding to inotropes, impending renal failure, or oxygen saturation <90% despite mechanical ventilation.

### Final outcome

Regarding the outcomes of the patients, 1 patient (1%) died during the course of treatment, 79 patients (82%) recovered with the treatment, and 16 cases (16.6%) left the hospital against medical advice [Table 5].

## Discussion

Most studies have found that most snakebite victims are young adult males in their second to fourth decades of life.[10-15] In our study, we observed that males and farmers are the most common victims due to their involvement in outdoor activities.[10,13,16-20]

The most common species of snake in cases where it was possible to interpret from the description by the patients/relatives was krait, which is also reported by similar studies,[21-22] whereas a few studies also reported predominantly viperine bites, especially Russell's viper.[11,13,16,23,24] Almost half of the times, the patients/relatives could not describe the snake, even though fang marks or other symptoms suggestive of venomous bites were present. This is unsurprising given that these were frequently quick, defensive bites.[25] The patients were frequently terrified, which hampered their ability to identify the species even with their fair knowledge about the appearances of the snakes.[26,27] These patients were managed symptomatically.

Our discovery that males (68 cases or 70.8%) were more likely to be bitten by a snake than females (28 cases or 29.1%) is in agreement with many of the studies[10-13,17,21,28] since men comprise the majority of the working population in India.

In our study, we discovered that the majority of the victims were bitten in the late evening, similar to other studies.[10,28,29] This could be attributed to poor visibility, tall grass, crops, and the habit of going to the field to defecate.

**Table 4: Hospital arrival time**

| Time interval | No. of cases (*n*=96) | Percentage |
|---|---|---|
| <1 h | 18 | 18.8 |
| 1–4 h | 26 | 27.1 |
| 4–24 h | 05 | 5.2 |
| >1 day | 02 | 2.1 |
| Referred cases | 45 | 46.9 |

**Table 5: Final outcome**

| Outcome | No. of cases (*n*=96) | Percentage |
|---|---|---|
| Dead | 01 | 01 |
| Recovered | 79 | 82 |
| Leaving against medical advice | 16 | 16.6 |

The observation that bites on the lower limbs (81.2%) was common compared to other sites suggests that in most cases, the snake was stepped on inadvertently. This observation may also be due to most of the snakebites seen during the monsoon season while doing harvesting activities in rural areas.[7,10,13-15,17,29,30] However, a few studies reported a contrary finding that the upper limb was the most commonly affected body part, followed by the lower limb.[21,31]

The majority of patients arrived at the hospital and received primary care within 4 hours of being bitten by a snake,[8,12,28] whereas Anil Kumar *et al.* report that only a minority of cases reported to the health facility within 4–6 hours.[14] The factors determining early hospitalisation may be proximity of health care facilities and improved road connectivity in the area. One of the major causes of increased mortality could be delayed hospital admission. Factors that may cause a delay in seeking health care include a lack of transportation and an inability to afford transportation, as well as attempting traditional and folk medicine first rather than going to health care facilities.[25,32] The mortality rate from a snakebite is low, and if the victim is treated quickly enough, this mortality is potentially avoidable.[32,33]

According to previous research, the majority of snakebite cases were caused by non-venomous snakes, but venomous bites caused significant morbidity and mortality.[26]

We observed that cobra and krait snake bites could cause severe envenomation with local symptoms in this study. Because the bites were defensive, the majority of them could have been dry bites, resulting in insufficient venom injection.[25] The most effective treatment for snake envenomation is intravenous snake anti-venom.[33] The administration of either monovalent or polyvalent snake anti-venom, as well as access to hospital care within hours of the snakebite, is the most important factor in determining a positive outcome.[18,20] The mortality rate in our study was 1%, which is similar to those of studies by Yaqoob *et al.* (2.8%), Halesha *et al.* (3.8%), and Melit RJ *et al.* (3.3%).[13,17,24]

These facts highlight the importance of strengthening surveillance and to focus on the magnitude of the problem and aggressive management of snakebite victims.[34]

Farmers and field workers should be educated about the prevention and knowledge regarding snakebites.[35]

## Conclusion

This study conducted revealed that the majority of snakebite victims were males and were in the age group of 21–30 yrs. The lower limb was the most common site for snakebite with visible fang marks in about 57.2% of patients. The snake species was unknown in 41 cases (42.7%), and among the snake species that were identified, the most common was krait, followed by cobra. Neurotoxic envenomation manifestation was found in almost

half (53.1%) of the cases, followed by myotoxic manifestations. Symptoms of severe envenomation were found in 50% of the cases. About 46.8% patients were referred from other health care setups. Among those who had directly visited our hospital, almost half of them took 1–4 hours to arrive and only 35% cases arrived to the health care facility within an hour of snakebite. Most of the patients (82%) recovered with the treatment with very minimal fatality.

## Recommendations

In 2019, the World Health Organization (WHO) formulated a strategy with the aim of reducing mortality and disability caused by snakebite envenoming by 50% by the year 2030.[36] India bears over 50% of the worldwide burden of snakebites, accounting for more than 2.8 million cases and 45,000 deaths each year.[19,35,37] In comparison to other neglected tropical diseases, estimating the burden of snakebites is challenging. Only 22% of snakebite victims seek treatment at health facilities, and a mere 7% of snakebite deaths are officially recorded.[19,38] Consequently, there exists a significant disparity between the official data and the findings of published surveys. This has led to an under-estimation of the need for ASV by national health authorities owing to poor data on snakebite envenomation. Therefore, there is a compelling need to devise and implement a comprehensive national health program with various components, such as management protocols including judicious use of ASV, scientific first aid methods, awareness programs for the general public and paramedical health workers, and the establishment of a hospital-based snakebite registry to collect and analyse data on snakebites for preparedness and program evaluation.[39] Efforts should be made to create awareness regarding taking extra preventive measures to prevent incidences of snakebites; for example, they should be warned not to disturb snakes, to avoid walking barefoot, and to wear protective boots.[35] High-risk persons are also advised not to sleep on floor, to use bed nets,[40,41] and to make use of a torch while walking at night.[42] Moreover, in the era of digital technology, the utilisation of information technology can also be leveraged for the effective implementation of the health program. Mobile phone-enabled and web-based apps can be employed to facilitate education and communication activities as well as assist frontline workers in making informed decisions in a timely manner.[43]

## Limitations

The major limitation of this study is that it is a retrospective chart review, and some of the important data may be incomplete or insufficient, so the exact statistics may not be reflected. In almost 40% of the cases, the species of snakes were not identified.

## Patient's consent

In this study, no consent was taken as it was a retrospective study. From hospital records we collected all the required data. Permission was taken from medical superintendent, to access the patient details and to use the data for only educational research purpose.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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