



## Original Research Article

## A study of clinical profile of snake bite at a tertiary care centre

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## ABSTRACT

**Introduction:** Because India has long been a land of exotic snakes, snakebite is a serious occupational and rural hazard. Physicians pay very little attention to this occupational hazard despite the high morbidity and death.

**Objective:** To study the various clinical profiles and the time interval between bite and start of treatment.

**Materials and Methods:** Patients were categorized based on the envenomation centred by patient history and definitive bite evidence and graded (I-IV) grounded on a series of manifestations observed in association with the onset of treatment time that distinguishes a venomous from a non-venomous snake attack. Patients were obligating local inflammation owing to tourniquet use besides local innate therapies.

**Results:** Of the 100 patients deliberated, it was evident that there existed a minimal difference between the bites instigated by the snake type. Higher abnormal clotting was perceived on the arrival of patients (78%). While envenomation was predominantly reported to prompt primary coagulation abnormalities (84.32%), neurotoxin manifestation was also found to occur at a lower rate (11.76%). Both symptoms were also observed at a minimal level (3.92%). Higher rates of renal failure were also reported and the clotting time normalization depended largely on patient admission time post-attack. In this investigation, the time gap between the bite and the commencement of therapy was not associated with the time required to normalize the coagulation abnormalities or develop a complication.

**Conclusion:** The study also proposes appropriate protective and awareness measures that could save humankind and these reptiles together.

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## 1. Introduction

Snakes are ectothermic limbless reptiles of the order Serpentes that are not found habituating only Antarctica. With over 3,900 species, these limbless predators are broadly categorized based on the possession of venom.<sup>1</sup> Concealing over 300 snake species, India has a significant proportionality (20%) of them are venomous snakes, among which four species worry the most (Cobra, Krait, Russell viper, saw-scaled viper).<sup>2</sup> While most of India's population is dependent on agriculture, settled in the rural areas,

significant morbidity is said to have been reasoned by snake attacks, designating snakebite as an occupational hazard. With a delineation of snakebite as a tropical disease in 2002 and subsequent status withdrawal in 2017, snake bites still cause many deaths worldwide.<sup>3</sup> With over 58,000 deaths in 2020, snake bites in India are reported to incur losses comparable to 3,000,000 years of well-being besides productivity, leaving survivors with incapacitating illnesses, such as amputation, renal disease, and severe scarring<sup>4</sup>

Recording the highest snakebite cases globally, the mortality scale and morbidity decrees of snake attacks are still under-rated in India. Only a few snakes attacked victims get treated or reach the hospitals.<sup>5</sup> The time

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interval between bite and onset of treatment plays a crucial role in survivability, and clinical manifestation is crucial.<sup>6</sup> However, clinical features depend on the venomous possession and species of the snake. General clinical features associated with snakebite range from local cellulitis, regional lymphadenitis, prolonged clotting time to a venomous bite and presence or absence of local swelling with normal clotting time to a non-venomous snake attack. Anxiety could also exaggerate the index of morbidity. Following a snake attack, a primary first aid practice involving the affected area's immobilization and an immediate hospital transfer for either anti-snake venom (ASV) or dry-bite therapy should be carried out.<sup>7</sup> Designated as a medical emergency, snake bite is recurrent in rural areas in India and many parts of the world.<sup>8</sup> Yet, a very diminutive devotion is waged to manage this occupational hazard.<sup>9</sup>

Hence, the present study was carried out retrospectively to help understand the clinical features of the local species of snakes that generally cause innumerable clinical severities and analyze the relativity between the severity of clinical manifestations and the time of onset of treatment.

## 2. Methods and Methods

This observational study was carried out in the department of internal medicine wards of Thanjavur Medical College Hospital from Jan 2016 to May 2016. A total of 100 cases of snakebite were admitted to medical wards during the study period. Following consent, data were collected via an interview with study subjects hospitalized during the study period using a predesigned, pretested, and structured questionnaire. Additionally, detailed information on demographic and epidemiological parameters such as age, sex, residence, occupation, site and location of the bite, type of snake, if identified, was obtained, and information on first aid was administered.

Time interval to reach the health facility after snake bite and first aid received if any were asked. A thorough clinical examination was carried out in each case. An opinion from the treating physician was taken to identify the type of snakebite (Vasculotoxic, VT, Neuroparalytic, and Non-poisonous). In addition, the following information was collected on the patient's day of discharge or death from the case paper the patient.

Neurotoxic manifestations such as ptosis and dysphagia, and external ophthalmoplegia were also included in the study. On the other hand, patients with a history of an unknown bite, with or without local swelling and a normal clotting time, were included as non-venomous.

The study population is divided according to severity into four grades; Grade I: History of snakebite, with or without cellulitis, Normal clotting time, Grade II: Local cellulitis, Regional lymphadenitis, Normal clotting time, Grade III: Prolonged clotting time, with or without local

features, Grade IV: Local features, Prolonged clotting time, with systemic bleeding.

The basic investigations include blood tests of TLC, Differential counts, Red blood cell count, Platelets count, and Urine routine. The bleeding time, clotting time, and the prothrombin time was also recorded. The Quantitative estimation of serum electrolyte, Plasma Fibrinogen levels were recorded. A special investigation of the DUPLEX - B mode Doppler study was also done. A Compartment Pressure study was done for 43 patients with cellulitis by the "syringe manometer" technique. Tissue compartment pressure can be measured using the "syringe manometer" technique with minimal equipment available.<sup>10</sup>

## 3. Results

The study reviewed 100 snake bite encountered patients within the age group from 8 to 70 years (mean age 28 years). The reported cases were predominantly caused by venomous snakes (51%), with non-venomous snake attacks also contributing to a significant part, 49% (Figure 1). Initial observation revealed neurotoxic manifestation in 6 patients, hemostatic and neurotoxic abnormality in two and 49 patients with no features suggestive of snakebite. With a majority of snakebite cases unidentified (72.55%), Saw Scaled Viper (17.65%), Russel Viper (5.88%), Krait (3.92) dominated the identified ones (Table 1).

**Table 1:** Distribution of species of snakebite

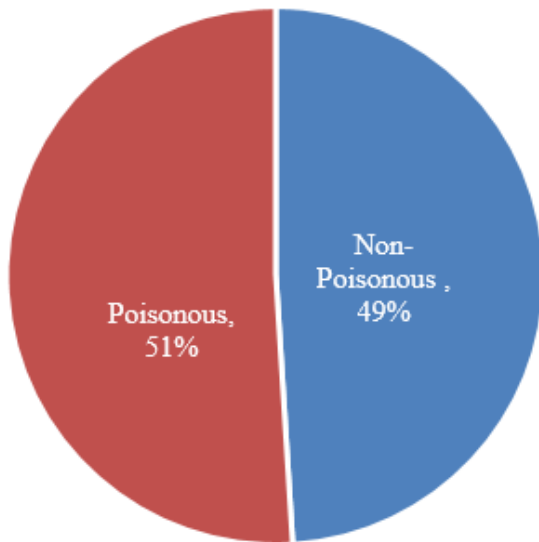
Type of Snake	Total	Percentage
Russel Viper	3	5.88
Saw scaled Viper	9	17.65
Krait	2	3.92
Unidentified	37	72.55

The bites were predominantly on the lower limb (66.66%) compared to the upper limb (33.34%). The average hospital stay of snake-bitten individuals with clotting abnormality was 6 days.

A clinical and clotting time gradation categorized patients under IV groups. The population belonging to this study fell under three categories (I-12 patients, II-27 and III-12) only.

Most of the patients exposed to envenomation (72%) displayed signs of prolonged clotting time during admission with a mean bleeding time of 2 - 6 minutes. Patients under categories II and III were recorded with decreased platelet counts (Table 2). A total of 14 patients out of 51 envenomated displayed systemic bleeding. Of the 55 % who presented with hematuria, 40% had hematemesis, and 5 % had hemoptysis, gum bleed, or subarachnoid haemorrhage.

The onset of abnormal coagulation was analyzed in patients who had both normal clotting times at the time of admission and abnormal coagulation later and those who had prolonged clotting during admission. Patients with



**Figure 1:** Distribution of snake bite

**Table 2:** Laboratory profile of snake bite

Laboratory Profile	Mean	Standard Deviation
Bleeding Time	3.74	1.56
Clotting Time	9.54	1.85
PT – INR	20.8	1.05
Urea	42	1.26
Creatinine	2.1	1.36

prolonged clotting time were also observed with prolonged prothrombin time (PT). The time for normalizing clotting was also analyzed in patients categorized under grades II and III, using a fixed regimen for ASV as standard. Average clotting time normalization was 8.1 hours in patients of grade II and 18 hours for patients under grade III. A correlation between the times of the bite, initiation of therapy, and development of complications was done (Table 3).

It was evident from the analysis that the onset of therapy time did not have any influence on the development of complications like renal failure and shock. The time interval between bite and onset of ASV treatment also did not have any effect on the clot normalization time. The only bite and therapy time-dependent parameter was the severity of envenomation that increased with delay in hospitalization. Among patients with compartment syndrome, elevated renal parameters returned to normal within 2 to 4 days in 5 of them who underwent fasciotomy. 10 cases went for peritoneal analysis, with positive urine myoglobin, among those with no fasciotomy.

Of the patients who developed renal failure, 56% belonged to grade II, followed by grades III (34%) and grade I (10%). Despite a normal coagulation profile,

patients in grade I developed renal failure. It was also evident that envenomation severity increased renal failure, which was also proportional to FDP levels and positive urine myoglobin than platelet count.

#### 4. Discussion

Snakebite is a rapidly treated illness that mostly affects tropical nations, with South Asia, particularly the Indian subcontinent, having the greatest rate of snakebite poisoning-related mortality. Snake-bite poisoning affects roughly 200,000 individuals in India each year, with 15,000 to 30,000 victims dying. With a CDR of 4.7 per 100,000 patients, Tamil Nadu is one of the states with a high incidence of snake-bite-related mortality.<sup>11</sup> Because of the habituation of over 50 venomous snake species in India, the rate of snakebite fatality is especially high among agricultural labourers. In India, four poisonous land snakes primarily constitute a public health risk. They belong to the elapidae family, which includes cobra (*Naja naja*) and krait (*Bungarus caeruleus*), as well as the viperidae family, which provides for Russell's viper (*Daboia russelii*) and saw-scaled viper (*Echis carinatus*).<sup>12</sup> The current investigation was carried out to investigate the various clinical characteristics and the time gap between bite and commencement of therapy.

100 patients were admitted for ASV to the medical ward within the study period. The study affirmed that snakebite is a recurrent life-threatening environmental and occupational hazard resulting in high mortality rates and morbidity severities in the study area, with a predominantly involved in agricultural activities. This also explains the larger frequency of snake bites in rural regions, which may be related to farming as a profession, the propensity to go barefoot, and thatched unprotected dwellings.<sup>11</sup> This was in agreement with Warrell, who has reported that the highest incidence of snakebite is recorded in agricultural workers in South East Asia.<sup>13</sup> The mean age of patients admitted for ASV in the study was 28. In a previous study, the mean age of ASV patients was also recorded as 29. This could be attributed to higher outdoor activity of the members within the age group 8-40. According to the earlier observation, the lower limb was the major bite site.<sup>11,14</sup> They also reported a minor portion of patients who contracted bites in the upper limb (19.3), similar to our study.

Although substantial bites have not been identified, the most common snake attacks were recorded to have been caused by a krait, cobra, saw-scaled viper, and Russel viper. Even in a parallel study, many snake bites accounted for unidentifiable species that among the identifiable recorded saw-scaled viper, cobra and russel viper as most common in Tirunelveli and Bengaluru, South Tamil Nadu, India.<sup>11,14</sup> Predominant bites were instigated by venomous snakes, among which hemotoxicity was observed in most of the patients compared with neurotoxicity. A

**Table 3:** Analysis of the relationship between the time of bite initiation of therapy, development of complications

Time of onset treatment (hours)	Grade	Number of cases	Average no. of ASV	Return of clotting time to normal	Number of cases with RF and shock
0 – 5	G II	12	14.5	8.8	2*
	G III	2	15	9	1
5 – 10	G II	8	14.5	8.7	2*
	G III	6	17	11.6	1
10 – 15	G II	4	10.5	10	0
	G III	2	11.5	11	0
>15	G II	3	8	7	1
	G III	2	15	20	1

small number of patients displayed both neuro as well as hemotoxic effects. Although bitten by a venomous snake, the expectancy of envenomation is only 50%. A likely dominance in the prevalence of haematotoxic manifestation was reported earlier by many studies in similar demography.<sup>11,12,14</sup>

The clotting time was found to increase in all patients irrespective of bite time and onset of hospitalization. A similar study at Orissa confirmed that prolonged clotting periods are definitive signs of envenomation or dry snake bite.<sup>15</sup> The current study patients admitted all displayed an enhanced clotting time period by 95%, developing abnormalities later post-hospitalization. A reduction in platelet count was also observed. A similar study conducted by Reid<sup>16</sup> and Mohapatra et al.<sup>15</sup> showed that 95% and 93% reduction in platelet counts were observed in all cases of definite envenomation. Reid also reported the extension in prothrombin and thrombin activation times, which was reported in the current study in grades II and III patients.<sup>16</sup> The grade II and III patients were also reported with lower fibrinogen levels. The lower the fibrinogen levels higher the severity of envenomation manifestations. Wintrobe also reported a similar correlation between lower fibrinogen levels and the severity of complications.<sup>17</sup>

Acute renal failure was observed in patients in all grades. The current study also reveals the positive influence of fasciotomy on the normalization of elevated renal parameters. In a similar study conducted by Meenakshi et al., patients with definite envenomation experienced acute kidney injury, which was predominant in patients with haematotoxicity.<sup>11</sup> Sambyal previously reported that the incidence of acute renal failure after a viper bite is 13-32 percent.<sup>18</sup> The study enforces the importance of time lapse between onset of bite and treatment time as an overall implication. Moreover, the lag time of hospitalization has been reduced over time from 6.3 to 0.5 hours, similar to our study that reports the maximum number of victims to reach the hospital within an hour. Better information on snakebite treatment and understanding that such a facility was available at the Medical College Hospital aided in reducing this. Instead of wasting time with

strange treatments, sufferers were most likely transported to the hospital.<sup>19</sup> Among the morbidities associated with a snake bite, 27 patients were observed with local cellulitis, regional lymphadenitis, and normal clotting time. Unaffected clotting time was almost associated with a higher number of Grade II patients admitted within an hour of bite and a decrease in Grade II patient number as time progressed, evidently affecting clotting time normalization. Our study also indicates the progression of severity from normal clotting time in Grade II to prolonged bleeding time in Grade III with delay in hospital admission. Although the clot normalization time did not have any timely effect on the grounds of earlier hospitalization, delayed onset of therapy severely influenced envenomation complications. The current study also records the existence of renal failure and shock in many grade II patients' despite early hospitalization. This could be accounted for higher rates of viper bites capable of inducing toxic nephropathy that causes a rapid renal impairment or failure.<sup>20</sup> Occurrences of elevated renal parameters and cellulitis and unhealed wounds were reported as morbidities in the majority of hemotoxic snake bite victims in a similar study.<sup>11</sup> Hence our study indicated a positive prognosis in ASV treated patients that were relatable only to bite severity and not the treatment time. A likely dis-association of treatment time with patient prognosis was earlier affirmed by Reid et al.<sup>16</sup>

## 5. Conclusion

India records the highest number of cases related to snake attack-related illness and deaths every year. With an established ASV and dry bite management action plans established widely in almost every health care centre throughout, higher mortality rates and envenomation-related disabilities are attributed to a lack of awareness of associated complications and the seeking of traditional medicine for treatments. Overall, the study implicates the significance of early treatment intermediation post-bite that reduced the envenomation manifestations and morbidity. Because of the patient's late arrival at the hospital, the incidence of problems was directly related to the time of venom in the blood before neutralization by ASV. Early ASV

administration effectively reduces consequences regardless of how severe the systemic envenomation is.

## 6. Source of Funding

None.

## 7. Conflict of Interest

None.

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