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Original Research Article

CLINICAL PROFILE AND PROGNOSTIC OUTCOMES OF SNAKEBITE PATIENTS ADMITTED TO A DISTRICT HOSPITAL: A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Snakebite envenomation is a major public health problem in India, particularly in rural areas, where it contributes significantly to morbidity and mortality. Early diagnosis and prompt administration of anti-snake venom (ASV) are essential for improving clinical outcomes and preventing complications. **Objectives:** To assess the clinical profile, laboratory findings, management, and in-hospital outcomes of snakebite patients admitted to a district hospital.

Materials and Methods: A prospective observational study was conducted among 100 consecutive snakebite patients admitted to the wards and intensive care unit of District Hospital, Chikkaballapura, Karnataka, from July 2022 to December 2023. Demographic details, type of snakebite, clinical manifestations, laboratory parameters, ASV requirement, treatment, and outcomes were recorded and analysed using descriptive statistics.

Results: The mean age of the patients was 37.95 ± 15 years, with males accounting for 72% of cases. Venomous snakebites constituted 72% of all cases, with viper bite being the most common, followed by cobra bite. The lower limb was the commonest bite site (57%). Pain and swelling were the predominant local manifestations. Among neuroparalytic envenomation cases, ptosis was the most frequent clinical feature (83.3%), followed by abdominal pain and vomiting (38.8% each). Prolonged PT/INR was present in 46.77% of venomous cases at admission and reduced to 9.6% after 24 hours of treatment. Most patients reached the hospital within three hours and recovered well following timely ASV therapy and supportive management.

Conclusion: Snakebite predominantly affected young and middle-aged males, with viper envenomation being the commonest presentation. Early hospital presentation and prompt ASV administration were associated with favourable outcomes. Strengthening community awareness, timely referral, and ensuring adequate ASV availability are essential to reduce snakebite-related morbidity and mortality.

Keywords: Snakebite, envenomation, viper, cobra, anti-snake venom, neuroparalysis; coagulopathy, prospective observational study.

INTRODUCTION

Snakebite envenoming is a major yet neglected public health problem in tropical and subtropical countries, particularly affecting rural populations engaged in agriculture and outdoor occupations. It contributes substantially to preventable morbidity, mortality, long-term disability, and socioeconomic loss. Owing to its significant disease burden, the World Health Organization has recognised snakebite envenoming as a high-priority neglected tropical disease and has emphasised the need for strengthening prevention, timely diagnosis, and effective management.[1] Despite improvements in

healthcare services and the availability of anti-snake venom (ASV), snakebite continues to cause a large number of deaths in low- and middle-income countries, largely due to delays in accessing appropriate medical care. India accounts for a considerable proportion of the global burden of snakebite envenoming. Most cases occur in rural communities where farming, plantation work, and other outdoor activities increase the risk of contact with venomous snakes. The incidence is usually higher during the monsoon season because of increased agricultural activities and displacement of snakes from their natural habitats following heavy rainfall.[2] The Indian cobra (Naja naja), common krait (Bungarus caeruleus), Russell's viper (Daboia russelii), and saw-scaled viper (Echis carinatus), collectively known as the "Big Four", are responsible for the majority of medically important snakebite envenomations reported in India.[3] The clinical manifestations of snakebite depend on several factors, including the species of snake, quantity of venom injected, site of the bite, time elapsed before treatment, and the victim's general health status. Neurotoxic envenomation commonly presents with ptosis, ophthalmoplegia, dysphagia, limb weakness, and respiratory paralysis, whereas haemotoxic envenomation is characterised by coagulopathy, spontaneous bleeding, acute kidney injury, shock, and multiorgan dysfunction. Local manifestations such as pain, swelling, cellulitis, blister formation, and tissue necrosis are also common and may result in significant disability if not managed promptly.[4] Early recognition of these clinical features and prompt initiation of appropriate treatment are essential for reducing complications and improving survival. Polyvalent ASV remains the definitive treatment for venomous snakebite. In addition to ASV administration, supportive measures such as airway protection, mechanical ventilation, correction of coagulation abnormalities, dialysis for acute kidney injury, and management of local wound complications play a crucial role in improving patient outcomes. However, delayed hospital presentation, dependence on traditional healers, inadequate awareness regarding appropriate first aid, and poor transportation facilities continue to adversely affect prognosis in many rural regions of India.[5] Community-based studies have also reported that a significant proportion of snakebite-related deaths occur before patients reach a healthcare facility, highlighting the importance of public awareness, early referral, and strengthening emergency medical services.[6]

Karnataka is one of the states with a high burden of snakebite because of its diverse ecology, extensive agricultural land, and predominantly rural population. Chikkaballapur district is largely agrarian, and a substantial proportion of its population is engaged in farming and horticulture, increasing the risk of snakebite. The District Hospital, Chikkaballapur, functions as an important secondary-level referral centre for managing snakebite cases from the district and neighbouring rural areas. Although many patients are treated annually, published data from this region remain limited. Previous studies have demonstrated regional variations in the epidemiology, clinical presentation, complications, and outcomes of snakebite, influenced by differences in snake species, healthcare accessibility, and treatment practices.[7,8] Therefore, the present prospective observational study was undertaken to evaluate the clinical profile, laboratory findings, management, and in-hospital outcomes of snakebite patients admitted to the District Hospital, Chikkaballapur, Karnataka.

Aim and objective: To evaluate the clinical profile, patterns of envenomation, treatment with anti-snake venom (ASV), and in-hospital prognostic outcomes among patients with poisonous snakebite admitted to the District Hospital, and to assess factors associated with disease severity, complications, and clinical recovery.

MATERIALS AND METHODS

Study design: A hospital-based descriptive prospective observational study.

Study setting: The study was conducted at District Hospital, Chikkaballapura, Karnataka, a secondary care government hospital catering to urban and rural populations of Chikkaballapura district.

Study duration: The study was conducted over a period of 18 months, from July 2022 to December 2023.

Study population: The study population comprised patients with snakebite admitted to the General Medicine wards and Intensive Care Unit (ICU) of District Hospital, Chikkaballapura, Karnataka.

Inclusion Criteria

1. Patients with a definite history of snakebite in whom the offending snake was identified by the victim or accompanying person.
2. Patients with a suspected history of snakebite presenting with definite acute local or systemic manifestations of envenomation in the absence of any other identifiable cause.

Exclusion Criteria

1. Bites caused by poisonous creatures other than snakes.
2. Patients with doubtful history of snakebite without definite clinical evidence of local or systemic envenomation.

Sampling method: The present study was conducted in the Department of General Medicine, District Hospital, Chikkaballapura, Karnataka. A total of **100 consecutive eligible patients** admitted to the General Medicine wards or Intensive Care Unit during the study period were enrolled after obtaining approval from the Institutional Ethics Committee.

Written informed consent was obtained from all participants. In the case of minors or critically ill

patients unable to provide consent, written informed consent was obtained from the legally authorised guardian.

A detailed clinical history was obtained and recorded using a predesigned case record proforma. The following information was documented:

- Time, place and anatomical site of the snakebite.
- Identification of the offending snake species, whenever possible.
- Details of first aid received before arrival at the hospital.
- Time interval between snakebite and hospital presentation.
- Demographic characteristics including age, sex and occupation.
- Clinical manifestations at presentation.
- Development of local or systemic complications.
- Response to treatment.
- Total dose of anti-snake venom (ASV) administered and any adverse reactions.
- History of alcohol consumption or recreational drug use prior to the bite.
- Relevant past medical history including chronic illnesses, current medications (especially anticoagulants and beta-blockers), previous snakebite requiring antivenom administration, and history of allergy to equine or other animal-derived antivenoms.

A thorough general physical examination and detailed systemic examination were performed in every patient, with particular emphasis on neurological, cardiovascular and local examination of the bite site.

The following laboratory investigations were carried out in all patients:

- Complete blood count (CBC)
- Liver function tests (LFT)
- Renal function tests (RFT)
- Fasting blood sugar (FBS)
- Postprandial blood sugar (PPBS), wherever indicated
- Prothrombin time (PT)
- Activated partial thromboplastin time (aPTT)
- International Normalised Ratio (INR)
- Electrocardiography (ECG)

Additional investigations such as computed tomography (CT) of the brain were performed whenever clinically indicated, particularly in patients presenting with altered sensorium or suspected intracranial haemorrhage. Neurological examination was performed serially to detect neurotoxic manifestations and central nervous system complications. Patients were managed according to the National Snakebite Management Protocol and institutional treatment guidelines. Clinical outcomes, requirement of intensive care, duration of hospital stay, complications and in-hospital prognosis were recorded.

Statistical Analysis: The collected data were entered into Microsoft Excel and analysed using Statistical Package for the Social Sciences (SPSS) software version 21.0 (IBM Corp., Armonk, NY, USA)**.** Continuous variables were expressed as mean ± standard deviation (SD) or median with interquartile range (IQR) depending on the distribution of data. Categorical variables were presented as frequencies and percentages**.** The results were summarised using appropriate tables and graphical representations. Descriptive statistical methods were employed to analyse the clinical profile, treatment characteristics and in-hospital outcomes of snakebite patients. A p-value <0.05 was considered statistically significant wherever inferential statistical tests were applied.

Ethical considerations: Prior approval was obtained from the Institutional Ethics Committee before commencement of the study. Written informed consent was obtained from all participants after explaining the study details. Participation was voluntary, and confidentiality of data was maintained throughout the study. The study was conducted in accordance with accepted ethical principles and research guidelines.

RESULTS

A total of 100 patients with snakebite were included in the present study. The mean age of the participants was 37.95 ± 15.0 years, with an age range of 17 to 73 years. The majority of participants (56%) belonged to the 31–60 years age group (Table 1). In the present study, the majority of the participants were male (72%), while 28% were female, indicating a marked male predominance among patients presenting with snakebite. Among these 56 participants, 44 (78.6%) had poisonous snakebite, indicating that envenomation was most commonly observed in the economically productive age group. In the present study, 28% of the patients had non-venomous snakebite, while the majority (72%) had venomous snakebite. Viper was the most commonly identified snake species responsible for envenomation, followed by cobra, which accounted for 13 cases. Among patients bitten by vipers, 86.2% developed clinical features of envenomation, indicating the high venomous potential of viper bites in the study population (Table 2). In the present study, the lower extremity was the most common site of snakebite, accounting for 57% of cases, followed by the upper extremity (41%). Among patients with lower extremity bites, 68.4% had poisonous snakebite with envenomation. One patient each sustained a snakebite on the trunk and the ear lobe, and both cases were due to poisonous snakes (Table 3). In the present study, 62% of the patients had seen the snake but did not bring it to the hospital, 27% had not seen the snake at the time of the bite, and 11% brought the snake for identification (Table 4). In the present study, the

majority of patients (35%) presented to the hospital within 1–3 hours of the snakebite. This was followed by 34% of patients who reached the hospital within 1 hour of the bite. However, 20% of patients presented 3–6 hours after the snakebite, indicating a delay in seeking medical care among a considerable proportion of cases (Table 5). In the present study, 48 patients presented with local toxicity at the bite site. Among these patients, 54.1% had vasculotoxic envenomation, while 25% had only local toxicity without systemic manifestations. In contrast, 14 patients did not exhibit local toxicity; however, 57.2% of them presented with neurotoxic manifestations, indicating that the absence of local signs does not exclude systemic neurotoxic envenomation (table 6). In the present study, pain at the bite site was the most frequently observed local manifestation, followed by swelling, making these the predominant local clinical features among snakebite patients (Table 7). In the present study, 18 patients had neuroparalytic envenomation. Among them, ptosis was the most common clinical manifestation, observed in 83.3% of cases. Abdominal pain and vomiting were the next most common manifestations, each occurring in 38.8% of patients (Table 8). In the present study, 48 patients had a haemoglobin (Hb) level >10 g/dL, while 3 patients had an Hb level <8 g/dL. With respect to the total leucocyte count (TLC), 20 patients had leucocytosis, whereas 2 patients had leucopenia. Regarding the platelet count, 3 patients had thrombocytopenia, with platelet counts <1 lakh/mm³ (Table 9). In the present study, at the time of admission, 46.77% of patients with poisonous snakebite had prolonged prothrombin time (PT)/international normalised ratio (INR) values. After 24 hours of hospital admission, the proportion of patients with prolonged PT/INR decreased to 9.6%, indicating significant improvement in coagulation parameters following treatment (table 10). In the present study, 8 patients required fewer than 5 vials of anti-snake venom (ASV) for treatment. In contrast, 6 patients with neuroparalytic envenomation required more than 50 vials of ASV, reflecting the higher antivenom requirement in severe neurotoxic snakebite (Table 11). In current study common major adverse reactions for ASV transfusion observed was hypotension among 5 cases (2-local toxic and 3 – vasculotoxic). Common minor complications observed are rash and itching among 8 cases (Table 12).

Table 1: Age wise prevalence of snake bite

Age group	Total no. of snake bite	No. of poisonous snake bite
17-30	34	16
31-60	56	44
>60	10	02

Table 2: Snakes responsible for bites

Type of snake	Total no. of bites	No. of bites with envenomation(%)	Dry bite(%)
Non venomous	28	-	-
Viper	51	44 (86.2 %)	7(13.8%)
Cobra	13	11(84.6 %)	2(15.4%)
Krait	8	7(87.5%)	1(12.5%)

Table 3: Incidence of snake bite with respect to the site of the bite

Site of bite	No. of Poisonous bites	No. of Non-Poisonous/DRY bites	Total
Upper extremity	21 (51.2%)	20 (48.7%)	41
Lower extremity	39 (68.4%)	18 (31.5%)	57
Trunk	01 (100%)	00	1
Ear lobe	01 (100%)	00	1

Table 4: Identification of snake

IDENTIFIACTION OF SNAKE	Frequency
Seen and brought (photograph after killing / killed snake)	11
Seen not brought	62
Not seen	27

Table 5: Time delay in presentation to the hospital after the snake bite

TIME DELAY IN PRESENTATION TO HOSPITAL	Frequency
Less than 1 hour	34
1 to 3 hours	35
3 to 6 hours	20
6 to 24 hours	9
>24 hours	2

Table 6: Incidence of poisonous snake bite with type of toxicity

TYPE OF toxicity	Only local toxicity(LT)	Vasculotoxic(VT)	Neurotoxic(NT)	Total
With local toxicity	12 (25%)	26 (54.1%)	10 (20.8%)	48
Without local toxicity	NA	6 (42.8%)	8 (57.2%)	14

Table 7: Incidence of symptoms of local toxicity

LOCAL TOXICITY	ONLY LOCAL TOXICITY N=12	VASCULOTOXIC N=32	NEUROTOXIC N=18
Pain	12	32	11
Swelling	12	26	10
Blistering	0	2	0
Ecchymoses	0	3	0
Tissue necrosis	0	2	0
Lymph node swelling and tenderness	1	4	0
Eschar formation	2	0	0

Table 8: Incidence of symptoms in neuroparalytic snake bite

Neuroparalytic symptoms	Frequency	Percentage
Ptosis	15	83.3 %
Diplopia	1	5.5 %
Ophthalmoplegia	1	5.5 %
Dysphagia	6	33.3 %
Drooling of saliva	5	27.7 %
Dyspnea	5	27.7 %
Unconsciousness	3	16.6 %
Limb weakness	1	5.5 %
Seizures	0	0 %
Pain abdomen & vomiting	7	38.8 %
Giddiness	1	5.5 %

Table 9: Laboratory abnormalities- hematological profile

Lab	Category	LOCAL TOXICITY N = 12	VASCULO TOXIC N = 32	NEUROTOXIC N = 18	Total
Hb	>10 g/dl	11	20	17	48
	8-10 g/dl	1	10	-	11
	<8 g/dl	-	2	1	3
TLC	4000-11000	5	21	14	40
	<4000	-	2	-	2
	>11000	7	9	4	20
NEUTROPHIL	NORMAL	5	21	14	40
	INCREASED	7	8	4	19
PLATELET	150000-450000	9	24	17	50
	>100000 TO <150000	3	5	1	9
	< 100000	-	3	0	3

Table 10: Coagulation profile

PT/INR	AT ADMISSION		24 HOURS AFTER ADMISSION	
	FREQUENCY	PERCENTAGE	FREQUENCY	PERCENTAGE
NORMAL	33	53.22 %	56	90.32 %
PROLONED	29	46.77 %	6	9.6 %

Table 11: Number of ASV required in poisonous snake bites

ASV required	Lt(N=12)	Vt(N=32)	Nt(N=18)
<5	4	3	1
5-10	3	7	1
10-30	5	16	8
30-50	-	6	2
>50	-	-	6

Table 12: ASV reactions

Major adverse reactions	Lt(N=12)	Vt(N=32)	Nt(N=18)
Hypotension	2	3	0
Bronchospasm	0	1	0
Minor adverse reactions			
• Chills	2	3	1
• Rigor	0	3	0
• Fever	0	1	0
• Rash	2	5	1
• Itching	2	5	1

Nausea/vomiting/abdominal pain	1	4	2
Any other symptom	-	-	-

DISCUSSION

The present prospective observational study evaluated the demographic profile, clinical manifestations, laboratory abnormalities and treatment outcomes among 100 patients with snakebite admitted to a district hospital in Karnataka. The findings reaffirm that snakebite continues to be an important medical emergency affecting the economically productive population and requiring prompt diagnosis and administration of anti-snake venom (ASV). The mean age of the study participants was 37.95 ± 15 years, with most patients belonging to the 31–60-year age group. A clear male predominance (72%) was observed. Similar observations have been reported in recent Indian studies, where males in the working-age group were more frequently affected because of their greater involvement in farming and outdoor occupations. The predominance of snakebite among young adults has important socioeconomic implications as it affects the most productive segment of the population. Venomous snakebite constituted the majority of cases in the present study, with viper bite being the most common identified species, followed by cobra. Most bites involved the lower extremities, and pain and swelling were the predominant local manifestations. These findings are consistent with recent reports from India, which have demonstrated that viper envenomation commonly presents with severe local tissue injury and predominantly affects the lower limbs because accidental bites usually occur while walking or working barefoot in agricultural fields.[9-13] Nearly one-third of the patients reached the hospital within one hour, while another 35% presented within 1–3 hours. Early hospital presentation probably contributed to favourable clinical outcomes in most patients. Nevertheless, one-fifth of the patients reached the hospital after more than three hours, highlighting the need for greater public awareness regarding immediate transport to healthcare facilities following snakebite. Early administration of ASV remains the cornerstone of management and significantly reduces morbidity and mortality.[14-16]

Among patients with neuroparalytic envenomation, ptosis was the most frequent manifestation, followed by abdominal pain and vomiting. Interestingly, more than half of the patients without local toxicity developed neurotoxic manifestations, emphasising that the absence of local swelling or pain does not exclude serious systemic envenomation. Similar observations have been documented in recent Indian studies, where neurotoxic bites, particularly due to cobra and krait, frequently presented with early ptosis followed by progressive paralysis. Haematological abnormalities were common in venomous snakebite. Almost half of the patients had prolonged PT/INR values at admission, which reduced substantially after 24 hours of treatment, demonstrating the effectiveness of timely ASV therapy in reversing venom-induced coagulopathy. Mild leucocytosis and thrombocytopenia were also observed in a subset of patients. Comparable laboratory findings have been reported in studies of viper envenomation, where coagulopathy, leucocytosis and thrombocytopenia are recognised markers of systemic toxicity. The ASV requirement varied considerably according to the severity and type of envenomation. While a few patients required fewer than five vials, six patients with neuroparalytic snakebite required more than 50 vials, indicating severe systemic envenomation requiring repeated dosing based on clinical response. Similar variations in ASV consumption have been reported in Indian tertiary care studies, where the dose is individualised according to persistent neurotoxicity or coagulation abnormalities rather than the snake species alone.[17-20] Overall, the findings of the present study highlight the predominance of venomous viper bites, early local manifestations, reversible coagulation abnormalities and favourable outcomes with timely ASV administration. Strengthening public awareness, improving early referral systems and ensuring uninterrupted availability of ASV at district hospitals are essential strategies for reducing snakebite-related morbidity and mortality in India.

CONCLUSION

Snakebite continues to be a major public health problem, particularly among young and middle-aged males. Viper envenomation was the most common type, with pain, swelling, coagulopathy and neuroparalytic manifestations being the predominant clinical features. Early hospital presentation and prompt administration of anti-snake venom were associated with favourable outcomes. Improving community awareness, ensuring timely referral and maintaining adequate anti-snake venom supplies at district hospitals are essential for reducing snakebite-related morbidity and mortality.

REFERENCES

1. Mohapatra B, Warrell DA, Suraweera W, et al. Snakebite mortality in India: a nationally representative mortality survey. PLoS Negl Trop Dis. 2011;5(4):e1018.
2. Suraweera W, Warrell D, Whitaker R, et al. Trends in snakebite deaths in India from 2000 to 2019 in a nationally representative mortality study. Elife. 2020;9:e54076.
3. Jadon RS, Sood R, Bauddh NK, Ray A, Soneja M, Agarwal P, et al. Ambispective study of clinical picture, management practices and outcome of snake bite patients at tertiary care centre in Northern India. J Fam Med Prim Care. 2021;10(2):933-940.
4. Melit RJ, Abraham SV, Radhakrishnan S, Palatty BU, Ajay A, Vimal KS, et al. Retrospective review of case records of

snakebite presenting to a single tertiary care centre over a 5-year period. Natl Med J India. 2021;34(6):326-332.
5. Vaiyapuri S, Vaiyapuri R. Snakebite envenoming in India: current scenario and future perspectives. Clin Toxicol (Phila). 2020;58(9):857-868.
6. Gutiérrez JM, Calvete JJ, Habib AG, Harrison RA, Williams DJ, Warrell DA. Snakebite envenoming. Nat Rev Dis Primers. 2017;3:17063.
7. Williams DJ, Faiz MA, Abela-Ridder B, et al. Strategy for a globally coordinated response to snakebite envenoming: an update. PLoS Negl Trop Dis. 2019;13(2):e0007059.
8. Gutiérrez JM, Burnouf T, Harrison RA, et al. A multicomponent strategy to improve the availability of antivenom for treating snakebite envenoming. Bull World Health Organ. 2014;92:526-532.
9. Longbottom J, Shearer FM, Devine M, et al. Vulnerability to snakebite envenoming: a global mapping study. Lancet. 2018;392:673-684.
10. Harrison RA, Hargreaves A, Wagstaff SC, Faragher B, Lalloo DG. Snake envenoming: a disease of poverty. PLoS Negl Trop Dis. 2019;13:e0007608.
11. Hooda R, Parameswaran N, Subramanian M. Serious adverse reactions to anti-snake venom in children with snake envenomation: an underappreciated contributor to snakebite mortality? Indian J Crit Care Med. 2021;25(6):720-723.
12. Kaur N, Iyer A, Sunagar K. Evolution bites—timeworn inefficacious snakebite therapy in the era of recombinant vaccines. Indian Pediatr. 2021;58(3):219-223.
13. Silva A, Isbister GK. Current research on snake antivenoms and next-generation therapeutics. Toxins (Basel). 2020;12:668.
14. Gutiérrez JM, Escalante T, Rucavado A. Experimental pathophysiology of systemic alterations induced by snake venom. Toxicon. 2016;119:218-228.
15. Longbottom J, Warrell DA. Snakebite in South Asia: epidemiology, management and prevention. BMJ. 2022;376:e057926.
16. Habib AG, Abubakar SB. Factors affecting snakebite outcomes in tropical countries: recent evidence. Trans R Soc Trop Med Hyg. 2011;105(8):437-444.
17. World Health Organization Snakebite Envenoming Working Group. Snakebite envenoming: a strategy for prevention and control. PLoS Negl Trop Dis. 2019;13:e0007059.
18. Silva A, Hodgson WC, Isbister GK. Antivenom for snakebite envenoming: current status and future directions. Toxins (Basel). 2023;15:92.
19. Whitaker R, Whitaker S. Venomous snakes of India and the burden of snakebite: recent advances in epidemiology and management. J Venom Anim Toxins Incl Trop Dis. 2022;28:e20220012.
20. Menon JC, Bharti OK, Aravind MS, Bawaskar HS, Mohapatra A, Punde D, et al. Cross-sectional survey of the incidence, mortality and socioeconomic burden of snakebite envenoming in India. Nat Commun. 2025;16(1):9871. doi:10.1038/s41467-025-64849-2.