e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com

International Journal of Pharmaceutical Quality Assurance 2026; 17(9); 14-18

Original Research Article

Snakebite: Clinical Features and Prognostic Consequences of Late Anti-snake Venom Treatment

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Received: 25-06-2026 / Revised: 23-07-2026 / Accepted: 26-08-2026
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Conflict of interest: Nil

Abstract:

Background: Snakebite envenoming remains an important emergency in tropical regions. Timely administration of antivenom and supportive care may reduce complications. This study assessed the clinical profile of snakebite patients and compared prognostic factors and outcomes between patients receiving early and delayed antivenom treatment.

Methods: A hospital-based case series was conducted over 18 months, from March 2023 to September 2024, among 45 patients admitted with an alleged history of snakebite and fang marks at the inpatient wards of the Department of General Medicine at BRIMS Bidar, Karnataka. Patients with pre-existing renal abnormalities, other neurological abnormalities, or bleeding diathesis were excluded. Clinical findings and laboratory parameters including complete blood count, urine examination, urea, and creatinine, electrolytes, bleeding time, clotting time, prothrombin time and ECG were assessed. Early treatment was defined as administration of antivenom within 6 hours of the bite; delayed treatment was administration at or after 6 hours. Categorical variables were compared using chi-square/Fisher's exact test and continuous variables using the independent t-test; $P<0.05$ was considered significant.

Results: The mean age was 33.09±12.84 years and 57.8% were male. Viper bites accounted for 60.7% of identified bites, and 57.8% of bites occurred at night. Lower-limb bites were most frequent (73.4%). Pain (95.6%), local edema (68.9%) and cellulitis (57.8%) were common local manifestations. Drowsiness and vomiting occurred in 71.1% each, while haematuria occurred in 37.8%. Thirty-two patients (71.1%) received early antivenom and 13 (28.9%) received delayed treatment. Delayed treatment was associated with hypotension, increased bleeding time, acute renal failure, respiratory distress, dialysis, ventilator support and death ($P<0.05$). Mean blood urea, serum creatinine, serum potassium, number of antivenom vials and hospital stay were significantly higher in the delayed-treatment group.

Conclusion: Delayed antivenom treatment was associated with greater haemostatic and renal abnormalities, more severe complications, increased treatment requirements and longer hospitalization. Early hospital presentation and timely antivenom treatment may reduce morbidity and mortality associated with snake envenoming.

Keywords: Snake Bite; Snake Envenoming; Antisnake Venom; Delayed Treatment; Acute Renal Failure; Prognosis.

DOI: 10.25258/ijpqa.17.9.4

Introduction

Snakebite is a major neglected public-health problem in tropical and subtropical regions, with substantial mortality, disability and socioeconomic consequences. In India, venomous snakes of major medical importance include the cobra, Russell's viper, saw-scaled viper and common krait. [1,2] The clinical manifestations vary according to the species, venom composition, quantity injected and time to effective treatment. [3,4] Viper envenoming commonly produces haemostatic abnormalities, local tissue injury and acute kidney injury, whereas elapid bites may produce neuroparalysis and respiratory failure. Delays in reaching definitive medical care can allow progressive envenoming and are associated with worse outcomes. [5-8]

In the study setting, patients often reached hospital after receiving first aid or treatment elsewhere. The present study was therefore undertaken to describe the clinical profile of snakebite patients and to compare prognostic factors and outcomes among

those receiving early versus delayed antisnake venom (ASV) treatment.

Aims and Objectives: To study the clinical profile of snake envenomation and to compare and analyse outcomes in patients who received early treatment and those who received delayed treatment.

Materials and Methods

Study design and setting: This was a hospital-based case series conducted in the inpatient wards of the Department of General Medicine at BRIMS Bidar, Karnataka, over 18 months from March 1, 2023 to September 31, 2024. The study included 45 patients.

Sample Size: The dissertation reports a calculated sample size of 44.17, rounded to 45 cases, based on a previous estimate of haemotoxic envenoming and calculated using OpenEpi version 2.3.1.

Participants: Patients presenting with an alleged history of snakebite and fang marks were included. Patients with pre-existing renal abnormalities (acute renal failure, chronic renal failure or nephrotic syndrome), other neurological abnormalities, or bleeding diathesis were excluded.

Data Collection: A detailed history included time and site of bite, suspected snake type, immediate systemic manifestations and treatment received before admission. First aid was provided to all patients. Clinical examination and investigations were performed serially. Investigations included complete blood count, urine routine examination, blood urea, and serum creatinine, serum electrolytes, bleeding time, clotting time, prothrombin time and ECG. Patients received ASV according to the clinical grade and progression of envenoming; patients with severe local edema or compartment syndrome underwent surgical intervention. Clinical progress was assessed daily.

Definition of Treatment Groups: Early treatment was defined as ASV administration within 6 hours of snakebite, while delayed treatment was defined as ASV administration at or after 6 hours. Prognostic factors included hypotension, haemostatic abnormalities, renal dysfunction, electrolyte imbalance, acute renal failure, respiratory distress, need for dialysis or ventilatory support, other interventions, ASV requirement, hospital stay and death.

Consent: Written informed consent was obtained from participants after explanation of the study in their own language.

Statistical Analysis: Data were entered into Microsoft Excel and analysed using SPSS version 16.0. Results were expressed as means/proportions. Chi-square or Fisher's exact test was used for categorical variables and the independent t-test for continuous variables. A P value <0.05 was considered statistically significant.

Results

Socio-demographic and exposure profile: Among 45 patients, 23 (51.1%) were aged 26–45 years, 15 (33.3%) were ≤25 years, 6 (13.4%) were 46–65 years and 1 (2.2%) was >65 years. The mean age was 33.09±12.84 years (range 18–72 years). Males constituted 57.8% and females 42.2%.

Table 1: Socio-demographic characteristics of the study participants.

Characteristic	n (%)
Age ≤25 years	15 (33.3)
Age 26–45 years	23 (51.1)
Age 46–65 years	6 (13.4)
Age >65 years	1 (2.2)
Male	26 (57.8)
Female	19 (42.2)

Among identified snake bites, viper bites were the commonest (17/28; 60.7%), followed by cobra (10/28; 35.7%) and krait (1/28; 3.6%); the snake type was unknown in 17 (37.8%) cases. Most bites occurred at night (57.8%), and the lower limb was the commonest site (73.4%).

Table 2: Type, timing and site of snakebite.

Exposure characteristic	n (%)
Known snake type	28 (62.2)
Viper among known bites	17 (60.7)
Cobra among known bites	10 (35.7)
Krait among known bites	1 (3.6)
Unknown snake type	17 (37.8)
Night bite	26 (57.8)
Morning bite	10 (22.2)
Evening bite	5 (11.1)
Afternoon bite	4 (8.9)
Lower-limb bite	33 (73.4)
Upper-limb bite	11 (24.4)
Head/neck bite	1 (2.2)

Clinical manifestations: Pain was the most frequent local manifestation (95.6%), followed by local edema (68.9%) and cellulitis (57.8%). Neurotoxic manifestations included drowsiness and vomiting (71.1% each), ophthalmoplegia (42.2%), ptosis (40.0%) and respiratory distress (33.4%). Among vasculotoxic manifestations, haematuria was most frequent (37.8%), followed by oliguria (22.3%), gum bleeding (15.6%) and hypotension (6.7%). Acute renal failure occurred in 15.6% of patients.

Table 3: Clinical manifestations of snake envenoming.

Manifestation	n (%)
Pain	43 (95.6)
Local edema	31 (68.9)
Cellulitis	26 (57.8)
Blisters	10 (22.2)
Necrosis	4 (8.9)
Drowsiness	32 (71.1)
Vomiting	32 (71.1)
Ophthalmoplegia	19 (42.2)
Ptosis	18 (40.0)
Respiratory distress	15 (33.4)
Impaired consciousness	6 (13.3)
Haematuria	17 (37.8)
Oliguria	10 (22.3)
Gum bleeding	7 (15.6)
Acute renal failure	7 (15.6)
Anuria	5 (11.2)
Hypotension	3 (6.7)

Treatment and laboratory findings: All 45 patients received ASV. Early treatment was received by 32 (71.1%) and delayed treatment by 13 (28.9%). Neostigmine was administered to 21 (46.7%) and fasciotomy was performed in 10 (22.2%). Adverse reactions to ASV occurred in 5 (11.2%). Increased bleeding time was present in 31.1%, increased clotting time in 6.7% and prolonged prothrombin time in 33.3%.

Table 4: Treatment, haemostatic abnormalities and major complications.

Treatment / laboratory variable	n (%)
Early ASV	32 (71.1)
Delayed ASV	13 (28.9)
Neostigmine	21 (46.7)
Fasciotomy	10 (22.2)
ASV adverse reaction	5 (11.2)
Increased bleeding time	14 (31.1)
Increased clotting time	3 (6.7)
Prolonged prothrombin time	15 (33.3)
Acute renal failure	7 (15.6)
Dialysis	5 (11.2)
Ventilator support	10 (22.3)

Comparison of early and delayed treatment: Delayed treatment was significantly associated with hypotension, increased bleeding time, acute renal failure, respiratory distress, dialysis, ventilator support and death. The mean prothrombin time, blood urea, serum creatinine, serum potassium, ASV vials required and hospital stay were significantly higher in the delayed-treatment group.

The delayed-treatment group had a markedly greater burden of severe outcomes. All deaths recorded in the study occurred in the delayed-treatment group. Dialysis and ventilator support were also concentrated in the delayed-treatment group. The mean hospital stay was approximately 4 days after early treatment compared with approximately 10 days after delayed treatment.

Discussion

This hospital-based case series describes the clinical profile of 45 patients with snakebite and demonstrates a consistent association between delayed ASV administration and adverse clinical outcomes. The mean age was 33.09 years and males constituted 57.8%, findings broadly comparable with several Indian hospital-based studies cited in the source dissertation. The lower limb was the commonest bite site (73.4%) and most bites occurred at night (57.8%), reflecting the exposure pattern described in other Indian series.

Viper bites were the commonest identified bites (60.7%), while a substantial proportion of patients could not identify the snake. The predominance of viperine bites is clinically relevant because vasculotoxic envenoming may result in coagulopathy, haemorrhage, hypotension and acute kidney injury. [9-12]

Table 5: Comparison of continuous prognostic variables between early and delayed treatment.

Variable	Early treatment	Delayed treatment	P value
Bleeding time (min)	4.41±1.26	5.30±1.58	0.05
Clotting time (min)	7.20±1.25	7.89±1.29	0.11
Prothrombin time (sec)	17.31±3.14	19.85±4.45	0.036
Haemoglobin (g/dL)	13.14±1.48	12.33±1.28	0.09
Total count (/μL)	8971.12±2044.87	9676.92±2637.25	0.34
Platelets (×10³/μL)	299.68±80.7	257.69±53.9	0.09
Blood urea (mg/dL)	30.88±37.15	90.15±91.74	0.003
Serum creatinine (mg/dL)	1.07±0.34	3.12±2.75	<0.0001
Serum sodium (mmol/L)	135.38±5.55	138.92±6.41	0.07
Serum potassium (mmol/L)	4.09±0.53	4.65±0.83	0.009
Serum chloride (mmol/L)	98.72±2.22	99.23±1.42	0.45
ASV vials	18.12±6.50	28.85±9.19	<0.0001
Hospital stay (days)	3.69±0.69	9.62±0.51	<0.0001

Pain, local edema and cellulitis were the dominant local manifestations. Neurotoxic manifestations were also frequent, with drowsiness and vomiting each occurring in 71.1%, followed by ophthalmoplegia and ptosis. These findings indicate that patients presented with a mixture of local, neurotoxic and vasculotoxic manifestations, underscoring the need for systematic assessment rather than reliance on identification of the snake alone.

The most clinically important observation was the relationship between delay in ASV administration and severity. Delayed treatment was associated with hypotension, increased bleeding time, acute renal failure, respiratory distress, dialysis, ventilator support and death. This is consistent with reports that increasing bite-to-treatment time is associated with greater severity and treatment requirements. [13-16] Renal dysfunction was particularly marked in the delayed-treatment group. Mean blood urea increased from 30.88±37.15 mg/dL in the early group to 90.15±91.74 mg/dL in the delayed group, while mean serum creatinine increased from 1.07±0.34 to 3.12±2.75 mg/dL. Serum potassium was also significantly higher after delayed treatment. These findings support the clinical observation that delayed envenoming can progress to acute kidney injury and electrolyte abnormalities.

Haemostatic abnormalities were also more prominent with delay. Mean prothrombin time was significantly higher after delayed treatment (19.85±4.45 versus 17.31±3.14 seconds). The source study further found higher proportions with increased bleeding and clotting times in the delayed group. These observations are clinically important because venom-induced consumption coagulopathy can evolve rapidly and requires repeated coagulation assessment.

The requirement for ASV and hospital resources was substantially greater with delayed presentation. Patients receiving delayed treatment required a mean of 28.85±9.19 vials compared with 18.12±6.50 vials after early treatment, and their mean hospital stay was 9.62±0.51 days versus 3.69±0.69 days. Similar associations between delayed treatment, increased ASV requirement and prolonged hospitalization have been reported in other studies. [13,14,17]

The study has limitations. It was a small, single-centre, hospital-based case series with purposive sampling. The sample size was only 45, limiting generalizability. Snake species identification was incomplete, and the observational design cannot establish causality between treatment delay and outcomes. Larger prospective multicentre studies would help confirm these associations.

Conclusion

Viperine bites were the most common identified snakebites, and most bites occurred at night and involved the lower limb. Pain, local edema, cellulitis, drowsiness, vomiting, ophthalmoplegia, ptosis and haematuria were frequent manifestations. Delayed ASV treatment was associated with greater haemostatic abnormalities, renal dysfunction, acute renal failure, respiratory distress, need for dialysis and ventilatory support, higher ASV requirements, longer hospitalization and death. The findings emphasize the importance of early transport to a medical facility, prompt assessment for envenoming and timely administration of ASV when indicated.

References

1. Logaraj M, Thirumavalavan R, Gopalakrishnan S. Epidemiology of snakebite reported in a Medical College Hospital in Tamil Nadu. Int J Health Allied Sci. 2013;2:53-55.
2. Bhalla G, Mhaskar D, Agarwal A. A study of clinical profile of snake bite at a tertiary care centre. Toxicol Int. 2014;21(2):203-208.
3. Thapar R, Darshan BB, Unnikrishnan B, et al. Clinico-epidemiological profile of snakebite cases admitted in a tertiary care centre in South India: a 5 years study. Toxicol Int. 2015;22(1):66-70
4. Siddique A, Kishore G, Ahmed EM, Khader HA. Epidemiological profile of snake bite at a tertiary care hospital Bengaluru, India. Arch Pharm Pract. 2015;6:58-63.
5. Chandrakumar A, Suriyaprakash TNK, Mohan PL, Thomas L, Vikas PV. Evaluation of demographic and clinical profile of snakebite casualties presented at a tertiary care hospital in Kerala. Clin Epidemiol Glob Health. 2016;4:140-145.
6. Meenakshi B, Shantaraman K, Indhumathi M, Arumugapandian SM. Clinical profile and outcomes of snake bite poisoning in a tertiary care centre in South Tamil Nadu. Int J Basic Clin Pharmacol. 2017;6(2):418-421.
7. Bhelkar SM, Chilkar SD, Suresh M. Study of snake bite cases admitted in tertiary care hospital in Nagpur. Int J Community Med Public Health. 2017;4(5):1597-1602.
8. Srivastava A, Gupta A, Singh SK. Epidemiological profile of snake bite at tertiary care hospital, East India. Int J Adv Med. 2017;4(5):1422-1428.
9. Kaveri VB, Patil SL. To study the utility of serum C-reactive protein and lactate dehydrogenase levels as markers of hemotoxicity in snake bite victims [dissertation]. Bagalkot, Karnataka: Rajiv Gandhi University of Health Sciences; 2016. p.1-82.
10. Mise YF, Lira-da-Silva RM, Carvalho FM. Time to treatment and severity of snake envenoming in Brazil. Rev Panam Salud Publica. 2018;42:e52.
11. Alirol E, Sharma SK, Bawaskar HS, Kuch U, Chappuis F. Snake bite in South Asia: a review. PLoS Negl Trop Dis. 2010;4(1):e603.
12. Singh S, Singh G. Snake bite: Indian Guidelines and Protocol. Medicine Update of API. 2013;94:424-426.
13. Ahmed SM, Nadeem A, Islam MS, Agarwal S, Singh L. Retrospective analysis of snake victims in Northern India admitted in a tertiary level institute. J Anaesthesiol Clin Pharmacol. 2012;28(1):45-50.
14. Dadpour B, Shafahi A, Monzavi SM, Zavar A, Afshari R, Khoshdel AR. Snakebite prognostic factors: leading factors of weak therapeutic response following snakebite envenomation. Asia Pac J Med Toxicol. 2012;1(1):27-33.
15. Saravu K, Somavarapu V, Shastry AB, Kumar R. Clinical profile, species-specific severity grading, and outcome determinants of snake envenomation: an Indian tertiary care hospital-based prospective study. Indian J Crit Care Med. 2012;16(4):187.
16. Krishnappa R, Chandrika DG, Gowda RM, Babu P, Banala R. A study on demographical and clinical profile and the outcome of snake bite victims in a tristate tertiary care center. Int J Med Sci Public Health. 2016;5(9):1818-1822.
17. Kakaria AS, Narkhede M, Agrawal S, Bhavsar A, Nukte V. A study of outcome of neuroparalytic snake bite patients treated with fixed dose of antisnake venom. Int J Res Med Sci. 2017;2(4):1676-1682.
18. Mahajan S, Mhaskar D. A study of clinical profile of snake bite at a tertiary care centre. Int J Recent Sci Res. 2015;6:6065-6068.
19. Patil HV, Patil A, Agrawal V. Clinical profile and outcome of envenomous snake-bite at tertiary care centre in western Maharashtra. Int J Med Public Health. 2011;1(4):28-38.
20. Moriarity RS, Dryer S, Replogle W, Summers RL. The role for coagulation markers in mild snakebite envenomations. West J Emerg Med. 2012;13(1):68.
21. Kumar KP, Basheer MP. Snake bite: biochemical changes in blood after envenomation by viper and cobra. J Med Allied Sci. 2011;1(1):36-41.
22. 22. Padhiyar R, Chavan S, Dhampalwar S, Trivedi T, Moulick N. Snake bite envenomation in a tertiary care centre. J Assoc Physicians India. 2018;66:50.