

Prevalence and Clinical Outcomes of Sepsis in Snakebite Patients: A Prospective Study at SCB MCH, Cuttack

Nirmal Chandra Sahu^{1*}, Bibhujit Padhy², Purna Chandra Pradhan³

¹Professor, Department of General Medicine, SCB Medical College & Hospital, Cuttack, Odisha, India

²Assistant Professor, Department of Emergency Medicine, MKCG Medical College & Hospital, Berhampur, Odisha, India

³Assistant professor, Department of Community Medicine, SLN Medical College & Hospital, Koraput, Odisha, India

***Address for Correspondence:** Dr Nirmal Chandra Sahu, Professor, Department of General Medicine, SCB Medical College & Hospital, Cuttack, Odisha, India

E-mail: nirmalchandrasahuscb@gmail.com

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ABSTRACT

Background: Snakebite may be complicated by secondary bacterial infection and sepsis, particularly due to tissue necrosis and unhygienic first-aid practices. This study assessed the prevalence of sepsis, associated clinical risk factors, and its impact on outcomes among snakebite victims in a tertiary care setting.

Methods: A prospective observational study was conducted at the Srirama Chandra Bhanja Medical College and Hospital (SCB MCH), Cuttack, Odisha, between March 2025 and March 2026. A total of 96 patients admitted with venomous snakebites were enrolled. We monitored basic clinical parameters (fever, heart rate, blood pressure) and simple laboratory values (white blood cell count, creatinine) to identify sepsis. Data were analyzed to compare outcomes between patients who developed sepsis and those who did not.

Results: Out of 96 patients, 28 (29.1%) developed sepsis. Delayed hospital arrival (>12 hours) and tight tourniquet use were significant risk factors. *Staphylococcus aureus* (35.7%) and *Escherichia coli* (25.0%) were the most common isolates. Sepsis was associated with longer hospital stay (14.2 vs. 5.1 days) and higher mortality (14.2% vs. 1.4%).

Conclusion: Sepsis is a frequent and serious complication of snakebites at SCB MCH, primarily driven by delayed treatment and harmful traditional first-aid. Relying on simple clinical signs and basic blood tests can help doctors catch sepsis early, start appropriate antibiotics, and ultimately save lives.

Key-words: Snakebite, Sepsis, Secondary Infection, SCB MCH Cuttack, Clinical Outcomes, Mortality

INTRODUCTION

Snakebite envenomation is a major neglected tropical health problem and an important medical emergency, particularly in rural and agricultural communities where close contact with venomous snakes is common. In India, snakebite remains an important cause of morbidity and mortality, with agricultural workers being particularly vulnerable to encounters with venomous species such as cobras, kraits, and vipers ^[1,2].

The clinical manifestations of snakebite depend on the type and amount of venom injected and may range from local tissue injury and necrosis to systemic complications involving bleeding, neurological dysfunction, and other organ systems. Prompt medical management, including appropriate administration of Anti-Snake Venom (ASV), is therefore essential in patients with significant envenomation ^[3,4].

Although the immediate management of snakebite primarily focuses on neutralizing venom and preventing systemic complications, secondary bacterial infection of the bite wound represents another important clinical problem. Snakebite wounds may become infected because of tissue damage, necrosis, contamination, and the introduction of bacteria from the snake's oral cavity ^[3,5]. Local tissue destruction caused by venom can provide a suitable environment for bacterial growth and

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may facilitate progression from localized wound infection to systemic infection and sepsis. Previous studies have documented bacterial infections following snakebite and have highlighted the importance of appropriate wound management and recognition of infectious complications [3,5,6].

The risk of infection may also be influenced by practices used before hospital admission. Cutting the wound, applying herbal or other substances, and using tight tourniquets may further damage local tissues and compromise blood supply, potentially increasing the risk of infection and necrosis. Such practices remain relevant in rural settings where patients may initially seek traditional or non-medical treatment before reaching a healthcare facility [1,4,7].

Sepsis following snakebite can substantially worsen the clinical course, prolong hospitalization, increase the need for surgical intervention, and contribute to mortality. However, the infectious complications of snakebite may receive less attention than the direct effects of envenomation [3,5]. Early identification of patients at risk of sepsis using clinical findings and basic laboratory parameters may therefore be particularly useful in tertiary-care and resource-limited settings.

The present study was undertaken to assess the prevalence of sepsis among patients admitted with venomous snakebite, identify associated clinical risk factors, and evaluate the effect of sepsis on clinical outcomes at SCB Medical College and Hospital, Cuttack, Odisha.

MATERIALS AND METHODS

Study Design and Setting- This was a prospective, hospital-based observational study carried out in the Department of Medicine at Srirama Chandra Bhanja Medical College and Hospital (SCB MCH), Cuttack, Odisha.

Study Period- The study spanned exactly one year, from March 2025 to March 2026.

Study Population- We enrolled 96 consecutive patients who were admitted with a history of venomous snakebite and signs of envenomation (either local swelling/necrosis or systemic bleeding/neurological signs). We excluded patients with "dry bites" (no venom injected) or those with pre-existing severe infections.

Inclusion Criteria

- Venomous snakebite patients with signs of envenomation.
- Admitted to SCB MCH during March 2025–March 2026.

Exclusion Criteria

- Dry bites.
- Patients with pre-existing severe infections.

Data Collection and Sepsis Criteria- To keep monitoring practical and universally applicable, we avoided complicated ICU scoring systems. Patients were monitored daily for basic clinical signs of sepsis, defined simply as the presence of a suspected infection (wound or systemic) alongside two or more of the following basic signs:

- Fever (Temperature $>38^{\circ}\text{C}$ or $>36^{\circ}\text{C}$)
- Elevated heart rate (>90 beats per minute)
- High breathing rate (>20 breaths per minute)
- Abnormal white blood cell count ($\text{WBC} >12,000/\text{mm}^3$ or $<4,000/\text{mm}^3$).

Statistical Analysis- Data were categorized into two groups: patients who developed sepsis and those who did not. We used simple statistical tests (Chi-square test for categories and Student's t-test for averages) to compare the two groups. A p-value of $p < 0.05$ was considered statistically significant.

RESULTS

A total of 96 patients were included in the study. Overall, 28 patients (29.1%) developed clinical sepsis during their hospital stay, while 68 patients (70.9%) recovered without septic complications. There was no significant difference in age or gender between those who developed sepsis and those who did not. Snakebites predominantly affected young to middle-aged males, reflecting the agricultural workforce (Table 1).

The time it took to reach the hospital and the use of harmful first-aid practices played a major role in the development of sepsis. Patients arriving after 12 hours had a significantly higher risk. Likewise, the application of tight tourniquets and the presence of severe local tissue death (necrosis) were strong, statistically significant predictors of sepsis (Table 2).

Table 1: Baseline Demographic Characteristics

Characteristic	Total Cohort (n = 96)	Sepsis (n = 28)	No Sepsis (n = 68)	p-value
Mean Age (years)	39.5	41.2	38.8	0.415
Gender: Male	62 (64.5%)	19 (67.8%)	43 (63.2%)	0.662
Gender: Female	34 (35.5%)	9 (32.1%)	25 (36.7%)	0.662
Bite on Lower Limb	78 (81.2%)	24 (85.7%)	54 (79.4%)	0.468

Table 2: Clinical Risk Factors and Pre-hospital Care

Clinical Factor	Sepsis (n = 28)	No Sepsis (n = 68)	p-value
Arrival > 12 hours	18 (64.2%)	14 (20.5%)	< 0.001
Tourniquet Applied	20 (71.4%)	28 (41.1%)	0.012
Wound Cut / Herbal Paste	11 (39.2%)	12 (17.6%)	0.035
Severe Local Necrosis	22 (78.5%)	15 (22.0%)	< 0.001

By the third day of admission, simple blood tests clearly distinguished the two groups. Patients with sepsis had markedly elevated White Blood Cell (WBC) counts

indicating severe infection. Furthermore, their kidney function was significantly worse, as shown by higher serum creatinine and urea levels (Table 3).

Table 3: Basic Laboratory Parameters on Day 3

Lab Parameter (Mean values)	Sepsis (n = 28)	No Sepsis (n = 68)	p-value
White Blood Cells (cells/mm ³)	18,400	9,800	< 0.001
Hemoglobin (g/dL)	10.1	11.4	0.065
Serum Creatinine (mg/dL)	2.8	1.2	0.002
Blood Urea (mg/dL)	65.4	32.1	0.004

Among the 28 patients who developed sepsis, we took wound swabs and blood cultures to identify the specific bacteria causing the infection. Gram-positive *S. aureus*

from the skin and Gram-negative bowel flora like *E. coli* (likely from the snake's mouth) were the most common culprits (Table 4).

Table 4: Microbiological Profile of Sepsis Patients

Bacterial Isolate	Number of Cases (n = 28)	Percentage (%)
<i>Staphylococcus aureus</i>	10	35.7%
<i>Escherichia coli</i>	7	25.0%
<i>Pseudomonas aeruginosa</i>	5	17.8%
<i>Klebsiella pneumoniae</i>	4	14.2%
Culture Negative	2	7.1%

The development of sepsis drastically altered the patient's recovery trajectory. Those with sepsis stayed in the hospital almost three times as long and had a

significantly higher rate of mortality. Sepsis proved to be a major determinant of survival (Table 5).

Table 5: Patient Outcomes

Outcome Measure	Sepsis (n = 28)	No Sepsis (n = 68)	p-value
Mean Hospital Stay (Days)	14.2	5.1	< 0.001
Required Surgery/Debridement	19 (67.8%)	6 (8.8%)	< 0.001
Mortality (Deaths)	4 (14.2%)	1 (1.4%)	0.021
Recovered & Discharged	24 (85.7%)	67 (98.5%)	0.021

DISCUSSION

The present study demonstrates that sepsis is an important secondary complication among patients with venomous snakebite. In our cohort of 96 patients, 28 (29.1%) developed clinical sepsis during hospital admission, while 68 (70.9%) did not develop septic complications. This finding highlights that, in addition to the direct effects of envenomation, secondary infection may significantly influence the clinical course and outcome of snakebite patients. Previous studies have described various complications following venomous snakebite and have emphasized the complex relationship between envenomation, infection, and systemic complications [8,9].

In the present study, delayed presentation to the hospital was significantly associated with development of sepsis. Among patients with sepsis, 64.2% arrived after 12 hours compared with 20.5% among those without sepsis. Delayed treatment may allow progressive tissue damage and local complications to develop before definitive medical management is initiated. Similar concerns regarding delayed presentation and adverse outcomes following snakebite have been reported in previous studies from India and South India [10,11]. These findings emphasize the importance of early hospital referral and timely medical intervention following venomous snakebite.

Harmful pre-hospital practices were also associated with sepsis in our study. Tight tourniquet application was reported in 71.4% of patients who developed sepsis compared with 41.1% of those without sepsis. Severe local necrosis was also considerably more common among septic patients. Prolonged restriction of blood flow may contribute to local tissue injury and necrosis, thereby creating favorable conditions for secondary bacterial infection. The importance of appropriate early management and avoidance of harmful practices has also been emphasized in reviews and guidelines concerning snakebite management [12,13].

The microbiological findings further support the role of secondary bacterial infection in these patients. *S. aureus* was the most frequently isolated organism, followed by *E. coli*, *P. aeruginosa*, and *K. pneumoniae*. Previous studies have similarly reported secondary bacterial infections involving a range of Gram-positive and Gram-negative organisms following snakebite [14,15]. The identification of these organisms is clinically relevant because infected and necrotic wounds may require appropriate antimicrobial therapy and, in severe cases, surgical intervention.

Sepsis was also associated with significant laboratory abnormalities. On the third day of admission, patients with sepsis had substantially higher WBC counts, serum creatinine, and blood urea levels than patients without sepsis. The elevated renal parameters indicate greater renal involvement among septic patients, which is consistent with the recognized occurrence of kidney-related complications following snakebite [12]. The use of simple parameters such as WBC count, creatinine, fever, and heart rate may therefore provide useful clinical information, particularly where advanced diagnostic facilities are limited.

Importantly, the development of sepsis was associated with poorer clinical outcomes. Septic patients had a considerably longer mean hospital stay (14.2 vs. 5.1 days), required more surgical/debridement procedures, and had higher mortality (14.2% vs. 1.4%) than patients without sepsis. These findings indicate that secondary infection can substantially increase morbidity and resource utilization in snakebite patients. Previous literature has also reported significant complications and adverse outcomes following snakebite envenomation [8,10,12].

Overall, our findings suggest that early recognition of infection, avoidance of harmful traditional first-aid practices, timely hospital presentation, appropriate wound care, and prompt management of suspected sepsis are important components of comprehensive

snakebite management. These measures may be particularly valuable in rural and resource-limited settings where delayed presentation and inappropriate first aid remain important challenges.

CONCLUSIONS

Sepsis complicates roughly one in three snakebite cases at this tertiary center, driven heavily by delayed presentation and harmful traditional first-aid practices like tourniquets. By relying on basic clinical signs and simple laboratory parameters like WBC counts and creatinine, physicians can easily and early identify patients at high risk. Broadening public awareness to abandon tourniquets and ensuring prompt antibiotic therapy for necrotic wounds are just as vital as ASV in preventing snakebite deaths.

CONTRIBUTION OF AUTHORS

Research concept- Dr Nirmal Chandra Sahu

Research design- Dr. Bibhujit Padhy, Dr. Purna Chandra Pradhan

Supervision- Dr Nirmal Chandra Sahu

Materials- Dr. Bibhujit Padhy

Data collection- Dr Nirmal Chandra Sahu

Data analysis and interpretation- Dr. Purna Chandra Pradhan

Literature search- Dr. Bibhujit Padhy

Writing article- Dr. Purna Chandra Pradhan, Dr. Bibhujit Padhy

Critical review- Dr. Purna Chandra Pradhan, Dr Nirmal Chandra Sahu

Article editing- Dr. Purna Chandra Pradhan, Dr. Bibhujit Padhy

Final approval- Dr Nirmal Chandra Sahu

REFERENCES

- [1] Warrell DA. Snake bite. *Lancet*, 2010; 375(9708): 77-88.
- [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] Garg A, Sujatha S, Garg J, Acharya NS, Parija SC. Wound infections secondary to snakebite. *J Infect Dev Ctries*, 2009; 3(3): 221-23.
- [4] Bawaskar HS, Bawaskar PH. Profile of snakebite envenoming in western Maharashtra, India. *Trans R Soc Trop Med Hyg.*, 2002; 96(1): 79-84.
- [5] Wagener M, Blanckenberg M. Secondary bacterial infection in snakebite wounds: a review. *Toxicon.*, 2021; 199: 118-24.
- [6] Mao YC, Liu PY, Hung DZ, et al. Bacteriology of Naja atra snakebite wounds and its implications for antibiotic therapy. *Am J Trop Med Hyg.*, 2016; 94(5): 1129-35.
- [7] 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.
- [8] Saravu K, Somavarapu V, Shastry AB, Kumar R. Clinical profile, complications and outcome of 336 patients with venomous snakebite in a tertiary care hospital in South India. *Asian Pac J Trop Biomed.*, 2012; 2(4): 275-78.
- [9] Resiere D, Mehdaoui H, Neviere R, et al. Sepsis, septic shock and snakebite envenomation: a complex relationship. *Toxicon.*, 2020; 185: 128-32.
- [10] Suchithra N, Pappachan JM, Sujathan P. Snakebite envenomation in Kerala, South India: clinical profile and factors involved in adverse outcomes. *Emerg Med J.*, 2008; 25(4): 200-04.
- [11] Chippaux JP. Snakebite envenomation turns again into a neglected tropical disease! *J Venom Anim Toxins Incl Trop Dis.*, 2017; 23: 38.
- [12] Vikrant S, Parashar A. Two decades of snakebite-induced acute kidney injury from a single center in Northwest India: a clinical epidemiology study. *Kidney Res Clin Pract.*, 2020; 39(4): 450-60.
- [13] Resiere D, Oliveira LS, Lebrun T, et al. Secondary bacterial infections complicating snakebite envenomation in Martinique: clinical and microbiological aspects. *Ann Clin Microbiol Antimicrob.*, 2020; 19(1): 41.
- [14] 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.
- [15] World Health Organization. Guidelines for the Management of Snakebites. 2nd ed. New Delhi: WHO Regional Office for South-East Asia; 2016.

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