

Serial Variation in Total Leukocyte Count as an Early Prognostic Marker of Complications in Snakebite Envenomation

Mariya Davis Paracka¹, Sujith JS^{2*}, Arundas H³

¹Junior Resident, Department of General Medicine, District Hospital Palakkad, Palakkad, India

²Associate Professor, Department of General Medicine, Palakkad Institute of Medical Sciences, Walayar, India

³Associate Professor, Department of Community Medicine, PSP Medical College, Chennai, India

***Address for Correspondence:** Dr Sujith JS, Associate Professor, Department of General Medicine, Palakkad Institute of Medical Sciences, Walayar-678624, India

E-mail: drsujiths@gmail.com

Received: 29 Jun 2026/ Revised: 10 Jul 2026/ Accepted: 24 Aug 2026

ABSTRACT

Background: Snakebite is a major medical emergency that can cause life-threatening systemic complications. Early recognition and timely ASV administration are crucial. TLC is an inexpensive, readily available marker that may reflect the inflammatory response to envenomation. This study assessed the relationship between serial TLC and complications of snake envenomation.

Methods: A prospective observational study included 400 snakebite patients aged >12 years at District Hospital, Palakkad, Kerala, from February 2023 to January 2024. TLC was measured at presentation and 6, 12, and 24 hours, with >11,000 cells/mm³ considered elevated. Associations with ASV requirement, AKI, haemodialysis, blood product transfusion, and ventilatory support were assessed using appropriate statistical methods and odds ratios.

Results: Among 400 patients, 233 (58.25%) were male and 167 (41.75%) female. Early presentation within 1 hour occurred in 268 (67%), with lower-limb bites being most common. The snake was identified in 137 (34.25%) cases, and ASV was administered to 95 (23.75%). Major complications included AKI (3.25%), haemodialysis (1.25%), blood product requirement (4%), and ventilatory support (1.5%). TLC >11,000 cells/mm³ was significantly associated with ASV requirement and all major complications at presentation and at 6, 12, and 24 hours (p<0.05).

Conclusion: High TLC was strongly associated with more severe snake envenomation and remained consistent during the first 24 hours. Serial TLC may serve as a low-cost adjunct for early risk stratification and monitoring, but normal TLC does not exclude significant envenomation or delay ASV administration. Further validation is needed.

Key-words: *Heliothis armigera*, *Argemone mexicana*, Ethanol, acetone, Epithelial lining, Epithelial cells, vacuoles, Gut lining, Gut wall

INTRODUCTION

Snakebite envenoming remains a significant yet preventable public health problem and an acute medical emergency with significant mortality and morbidities, which calls for high degree of awareness, knowledge, and immediate intervention. It has a strong predilection for rural population and predominantly afflicts farmers

and those who occupy land on which tropical and subtropical biomes thrive, this way creating an environment amenable to frequent animal/human interaction. The incidence seems 1.2-5.5 million bites per year worldwide with 421,000-1,841,000 envenomation and over 20,00094,000 deaths per year ^[1]. South Asia, South East Asia and sub-Saharan Africa represent the main problem areas for snake-bite envenoming. World Health Organization identified this as a neglected tropical disease in 2017 due to its high health impact ^[2].

India bears a significant burden of snakebite worldwide. While as many as 300 species are recorded within the country, only some are considered to be of clinical importance. The "Big Four" (the Indian cobra (*Naja*), the common krait (*Bungarus caeruleus*), Russell's viper

How to cite this article

Paracka MD, Sujith JS, Arundas H. Serial Variation in Total Leukocyte Count as an Early Prognostic Marker of Complications in Snakebite Envenomation. SSR Inst Int J Life Sci., 2026; 12(5): 11019-11027.



Access this article online

<https://ijls.com/>

(*Daboia russelii*) and the saw-scaled viper (*Echis carinatus*) have traditionally been considered to represent the major cause of serious bites [3], and snakebite usually occurs in rural or agricultural populations, where delay in transport, limited, or delayed access to healthcare centers, use of traditional remedies and different perceptions of initial management lead to a delay in appropriate treatment [4]. Early recognition of patients at risk of systemic envenomation and sequelae is that means an important clinical issue.

Snake venoms are complex mixtures of proteins, enzymes, peptides, and other biologically active molecules causing various local and systemic effects. Certain species and types of venoms cause admixture of neurotoxicity haemotoxicity nephrotoxicity, myotoxicity as well as cardiotoxicity and extensive local tissue damage. Clinically significant complications include neuromuscular paralysis and respiratory failure, venom induced consumption coagulopathy, thrombocytopenia, acute kidney injury rhabdomyolysis tissue necrosis, compartment syndrome, shock, and requirement for blood, renal replacement and ventilatory support [3,5]. Administration of antivenom is the only specific treatment available for neutralisation of circulating venom toxins. It is of note still, that the use of antivenom should be based on clinical and laboratory evidence of significant envenomation. Unnecessary use of antivenom results in possible adverse reactions and consumes valuable institutional resources [3].

Inflammatory responses are also important in the pathophysiology of snake envenomation. Venom enzymes such as phospholipases A2 and snake venom metalloproteinases can cause tissue injury, activate vascular endothelium, induce inflammatory cytokine release and promote the recruitment of leukocytes to the injured tissues. In addition, damage associated molecular patterns released from injured cells may activate key innate immune signaling pathways resulting in upregulation of inflammatory mediators and further recruitment of neutrophils [6]. Both in vivo models and clinical case series of snake envenomation are proven to cause leukocytosis most of all due to neutrophilia, and occasionally a left shift, which may act as a measure of the degree of envenomation induced tissue damage and systemic inflammation [6,7].

A number of studies have described other hematological parameters that are routinely available to be connected to severity of snakebite. Increased total leukocyte count and neutrophil count with relative lymphopenia have been observed more commonly in patients with moderate or severe envenoming. An increased neutrophil-lymphocyte ratio (NLR) has been described in association with severity, complications, and hospitalisation for snakebite [5,7]. These parameters potentially give fairly good indication of the magnitude of systemic inflammatory response to envenomation. Yet, most of these studies have largely been limited to admission haematology, with less prevalent serial change of total leukocyte count in the early post bite period.

Serial individual total leukocyte cell count is this way likely to provide further information over a single baseline measurement. A rising total leukocyte count may suggest an ongoing systemic envenomation and would in addition, potentially identify patients at a later date at risk of after that developing clinically significant complications. Stable total leukocyte cell counts in the absence of other clinical signs of systemic envenomation may help differentiating clinicians predict the patients who need prolonged observation and intervention, from others suitable for earlier discharge, in particular in environments where prolonged observation and treatment with antivenom may further tax limited healthcare resources [4,8].

Although there has been growing attention on hematological inflammatory markers including TLC, NLR and platelet-lymphocyte ratio, there is currently a lack of evidence evaluating the prognostic utility of serial TLC performed at predetermined times post envenomation. Further research in establishing whether any alterations in TLC between presentation and within the first 24 hours of envenomation can offer clinically meaningful information would be of value as an in particular simple, cost-effective, and readily available method of early risk assessment.

So our study evaluates the serial variation in total leukocyte count at presentation and at 6, 12 and 24 hours post snake bite and its association with clinically meaningful complications of snake bite envenomation. The study further seeks to determine that whether serial TLC can predict outcome like requirement of antivenom, acute kidney injury haemodialysis fasciotomy,

requirement of blood or blood products, requirement of ventilation amongst others. If the study finds such an association, then this may be an early prognostic marker of clinical outcome, which can aid a clinician not only in early suspicion of probable severity but also synergize with clinical assessment apart from road side laboratory investigations.

MATERIALS AND METHODS

Study Design and Setting- A prospective observational study was undertaken in the Department of Internal Medicine, District Hospital Palakkad Kerala. Patients admitted with a history of snake bite in to the Intensive Care Unit, High Dependence Unit, general medicine wards and observation room were studied in this study. The duration of study was one year (February 2023 to January 2024).

Study Population- Source of data the data sources were patients of Palakkad District and adjacent areas. Who reported to the Department of Internal Medicine, District Hospital Palakkad with snakebite during the study period. The patients were clinically examined at the first presentation and were followed up throughout in the hospital for systemic envenomation and complications.

Sample Size- The sample size was calculated based on the formula of prevalence: $n = Z^2pq/d^2$. Based on an estimated maximum prevalence (p) of 0.050, a confidence level of 95%, and 5% precision, the minimum sample size was about 400 patients. So, this study was to be conducted with a base of about 400 eligible patients having snakebite on their presentation to the hospital during the study period.

Study Period- The study was conducted for one year, from February 2023 to January 2024. Patients fulfilling the predefined eligibility criteria and presenting during this period were considered for enrollment.

Eligibility Criteria- Subjects older than 12 years old attending the Department of Internal Medicine with a history of snakebite were eligible for inclusion. Patients presenting more than 24 hours after the time of bite were excluded on the premise that delay in presentation should quite a bit alter the serial hematological response. Patients with hematological malignancy,

whether past or present, were excluded. Patients who had received immunosuppressive therapy or chemotherapy within the previous 12 months were excluded as these factors interfere with leukocyte levels. Patients younger than 13 years of age and patients unable to give consent to the study were also excluded.

Data Collection and Clinical Assessment- Following informed patient consent, demographic, and clinical data was recorded on predesigned study proforma. History of snake bite, clinical features and time of presentation was documented in the study proforma. A detailed clinical examination was done and laboratory investigations were noted. All patients were followed-up prospectively till discharge to record the clinical progress and complications of snake envenomation.

Serial Assessment of Total Leukocyte Count- The principal laboratory parameter evaluated was the total leukocyte count (TLC). TLC was measured at four predefined time points namely at presentation, 6 hours, 12 hours and 24 hours after snakebite. The serial leukocyte count was checked to evaluate the change of leukocyte count at early period after envenomation and their association with further clinical outcomes. Total leukocyte count was noted as part of complete blood count done in the institutional laboratory. Hematological analysis was performed using a five-part hematology analyzer based on the principles of electrical impedance and flow-cytometry. The serial TLC values were correlated with clinical course and development of complications during hospitalization.

Assessment of Clinical Outcomes- Patients were monitored up to discharge and any clinically relevant end points that occurred in hospital were recorded. The association between serial TLC and relevant complications or treatment end points of snakebite were nausea, the need for anti-snake venom, acute kidney injury haemodialysis fasciotomy, transfusion of blood or blood products and ventilatory support. The association between change in TLC and this end points were determined.

Data Collection and Management- Clinical and laboratory details were recorded in the study proforma provided in annexure of the study. Then the collected data were entered in Microsoft Excel for data

management and preparation for statistical analysis. Patient information was kept confidential and data used solely for the purposes of the study.

Statistical Analysis- Data were analyzed with the Statistical Package for the Social Sciences (SPSS) version 16.0. Descriptive analysis involved application of frequency distribution for the relevant categorical variables. The Chi-square test was used for assessing the association between categorical variables. The relevance of association of these variables was further evaluated and quantified using odds ratios. Serial measurements of the TLC were evaluated about subsequent complication and treatment related outcomes. A p less than 0.05 was taken as statistically significant.

Ethical Considerations- Institutional Human Ethics Committee approval was taken before starting this study. Before entry into the study, a written informed consent was taken from the study subjects. All the parts of the study were on voluntary basis, there were no intervention or interference with the usual diagnostic or therapeutic management of the snakebite patients, who did not give a consent for the study. All patients were treated as their clinical needs and hospital management guidelines.

RESULTS

A total of 400 patients with snake bite presenting to the institute were used in the study. Demographic and clinical features of the study population revealed a male preponderance, with males constituting 58.25% (n=233) and females 41.75% (n= 167) in the study population. Senior adults (>=60) were the largest group constituting 72% of the study population, followed by adolescents (13-18 years) accounting for 17% and adult patients (19-59 years) comprising 11%. Considering occupation, the highest number of manual labourers (n=151) was observed followed by housewives (n=107), the rest being skilled labourers professionals' students, unemployed persons and army personnel. As expected, a large number of manual labourers reflect the occupational exposure in a traditional and rural environment (Fig. 1a,b,c).

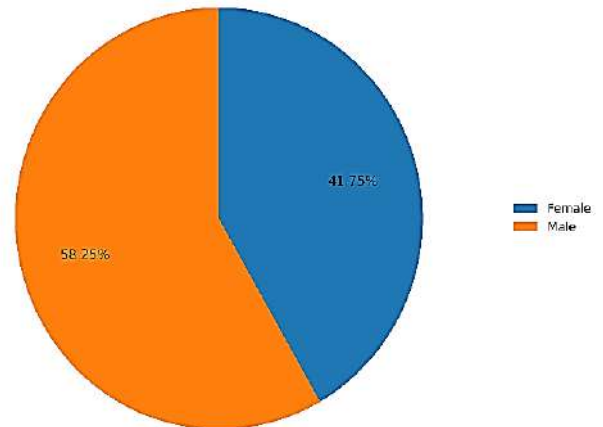


Fig. 1a: Gender-wise distribution of patients with snakebite.

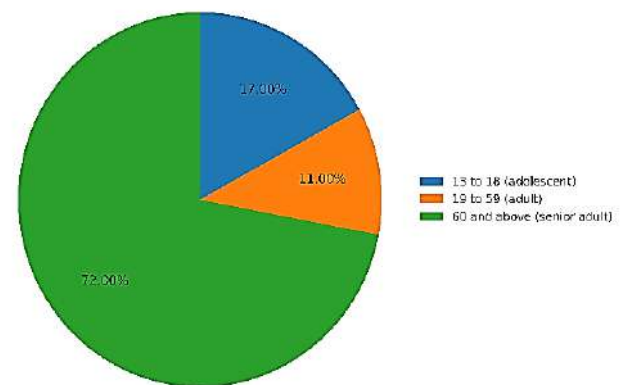


Fig. 1b: Age-wise distribution of patients with snakebite.

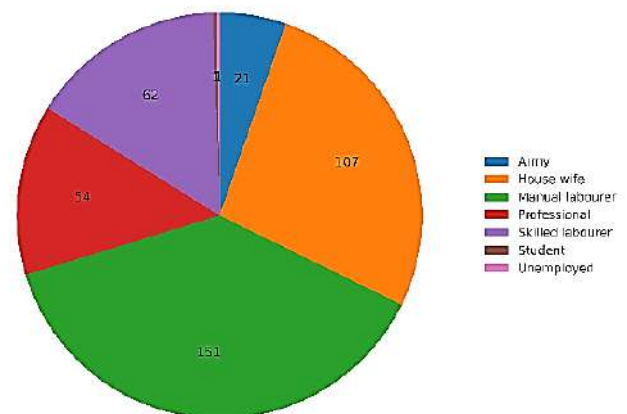


Fig. 1c: Occupational distribution of patients with snakebite

All patients arrived at the hospital relatively soon after the bite. Two hundred and sixty-eight patients (67%) arrived within 1 hour, between 1 and 6 hours and a further patient arrived between 6 and 12 hours. This highlights that 268 (67%) of the patients arrived in the early time period after snakebite.

The site of bite most frequently reported was the lower limb. The site of bite most frequently reported in the lower limb was the left lower limb. Upper limb cheek

head and neck back, ear, and ocular were also reported (Table 1).

Table 1: Time interval between snakebite and presentation to hospital

Time from bite to presentation	Number of patients	Percentage
Within 1 hour	268	67
1–6 hours	131	32.75
6–12 hours	1	0.25
Total	400	100

Only 34% of patients could identify the biting snake as poisonous or non-poisonous. 66% patients reported snakebite as unidentified. Russell's viper was the most frequently identified venomous snake species in the supplied dataset followed by cobra, saw-scaled viper, krait and pit viper. Overall, 95 out of 400 patients

(23.8%) received anti-snake venom (ASV) and 305 patients (76.3%) did not receive ASV. In 52 patients with an unknown snake, ASV was administered after the clinical evidence of envenomation developed. In the reported dataset, none of the patients with identified non-poisonous bites were administered ASV (Table 2).

Table 2: Distribution of ASV administration according to identification of the snake

Snake identification	ASV not administered, n	ASV administered, n	Total
Non-poisonous	89	0	89
Poisonous	5	43	48
Unknown snake	211	52	263
Total	305	95	400

Of the 400 patients studied 13 (3.25%) patients developed AKI. Haemodialysis was needed in 5 patients (1.25%) and blood or blood products were needed in 16

patients (4.0%). Ventilatory support was needed in 6 patients (1.5%) (Fig. 2).

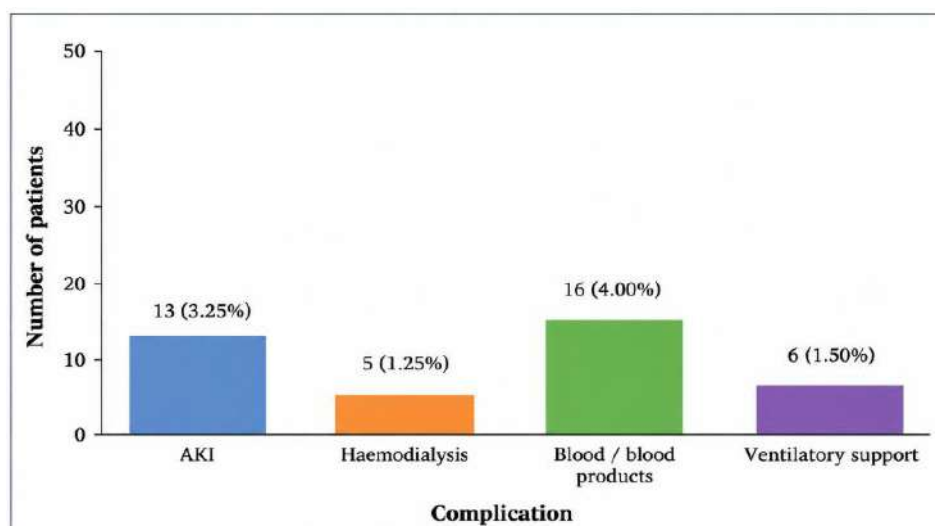


Fig. 2: Frequency of major complications among patients with snakebite.

The relationships between the total leukocyte count (TLC) and clinically significant outcomes were evaluated at four predetermined time points on presentation 6h

12h and 24h post bites. Patients were grouped into either $>11,000$ cells/ mm^3 or $<11,000$ cells/ mm^3 to evaluate the association (Table 3).

Table 3: Association between TLC $>11,000$ cells/ mm^3 and major clinical outcomes at different time points

Outcome	Presentation OR (95% CI)	6 h OR (95% CI)	12 h OR (95% CI)	24 h OR (95% CI)
ASV administration	21.89 (8.74–54.87)	141.38 (48.35–413.44)	476.00 (64.11–3542.50)	391.67 (23.72–6468.30)
AKI	21.33 (6.53–69.69)	74.00 (9.43–580.69)	86.80 (11.03–682.90)	173.76 (21.70–1390.60)
Haemodialysis	17.02 (2.74–105.58)	59.83 (3.27–1095.90)	68.92 (3.75–1264.25)	123.03 (6.65–2274.92)
Blood/blood products	3.79 (1.16–12.95)	7.38 (2.64–20.60)	8.59 (3.06–24.09)	16.34 (5.66–47.18)
Ventilatory support	23.42 (4.13–132.96)	71.87 (3.99–1292.78)	82.98 (4.60–1494.40)	21.87 (3.87–123.95)

All reported associations were statistically significant at $p < 0.05$; the majority had $p < 0.001$.

At all four assessment points, high TLC was associated with ASV administration and major complications, with odds ratios increasing over time. Associations with ASV, AKI, and haemodialysis were evident at presentation and strengthened at 6 and 12 hours, suggesting that TLC may serve as an early, readily available predictor of adverse

outcomes. Among patients with persistently normal TLC ($<11,000$ cells/ mm^3) at all four time points, 22 still received ASV compared with 296 who did not. Thus, persistently normal TLC was associated with a lower frequency of ASV administration and complications but did not completely exclude the need for ASV.

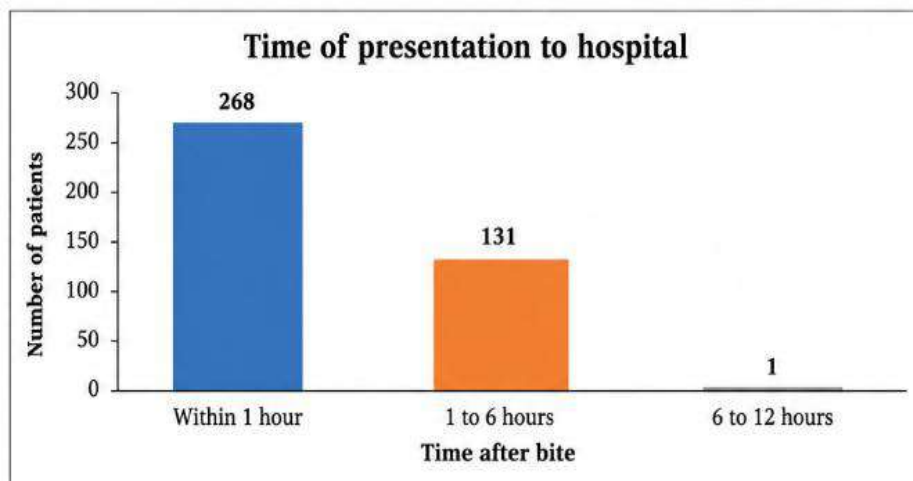


Fig. 3: Comparison of ASV administration among patients with TLC $<11,000$ cells/ mm^3 at all four assessment time points.

The main outcome of this study was that high TLC ($>11,000$ cells/ mm^3) at presentation and on serial assessment was a lot related to clinically significant outcomes of snakebite envenoming. Significant associations were identified with administration of ASV, developing AKI, requiring haemodialysis, requiring blood/blood products and requirement for ventilatory

support. Very particularly, this association was identified on presentation, so raising the possibility of using TLC as a potentially valuable early prognostic laboratory parameter in snakebite. The finding that a normal TLC during all observation periods did not entirely rule out the need for ASV was exemplified by the 22 patients who received ASV in the face of continually normal TLC.

DISCUSSION

There were 400 cases of snake bite in the present study of which females made up 41.75% of the study population. Many the patients were from the large adult age group and the most affected occupational group was manual labourers (37.75%) followed by housewives (26.5%). Bhalla *et al* also reported that the highest number of snake bite victims belonged to the manual workers followed by housewives ^[9]. Raju *et al* documented male sex predilection in the snake bite patients but in their study, the study population had a larger proportion of younger patients ^[10].

The relatively early presentation to hospital formed an important finding in this study with less than 1/3 of patients presenting to hospital greater than 1 hour from the bite. The proportion of patients presenting to hospital within the first hour was 13.5% in the Raina *et al.* study ^[11]. 64% of patients in this study presented to hospital between 1 and 6 hours. Such early presentation may be a reflection of increased public awareness and good access to emergency healthcare facilities over the years. Commonest sites to bite were lower limbs, accounting for just over 73%, with the left lower limb most frequently bitten (40.5%), then the right lower limb (32.5%). Pradhan *et al.* also reported a predominance of sites to bite over the lower-limbs ^[12].

There were only 34.25% patients who could identify the snake, while 65.75% of patients had unidentified bites. Pit viper was the most common species of venomous snake identified among identified snakes in our study as reported by Kumar *et al.* with a large number of unidentified bites ^[13]. In our study, 95 (23.75%) patients were given ASV, including 52 patients of unidentified bites, who showed evidence of envenomation. A total of 1408 vials were given to treat 95 patients, with an average of approximately 14.9 vials over each patient treated. These results highlight the importance of serial clinical and laboratory assessment in patients whose snake species is not known.

The notable systemic complications included AKI in 13 (3.25%), haemodialysis in five (1.25%), the need for blood/blood products in 16 (4%) and ventilatory support in six patients (1.5%). Out of the 13 who developed AKI, 5 needed haemodialysis. Five needed ventilatory support, which included four with neuromuscular picture and 2 with alveolar haemorrhage, eleven patients had neuromuscular manifestations and there were no cases

with compartment syndrome requiring fasciotomy and no death due to snake envenomation in the institution. Some patients were lost to follow-up or referred to other institutions and their final outcome was not known.

The key achievement of this study was association of high TLC with snake envenomation complications. The cutoff of $>11,000/\text{mm}^3$ was used in this study based on the previous study in which leucocytosis had been linked with adverse snakebite outcome. Krishnadas *et al.* had shown higher counts of leukocytes in toxic snake bite and deaths and Suchithra *et al.* had shown association of leucocytosis with complications using cutoff $11,000/\text{mm}^3$ ^[9-15].

In our study, TLC $>11,000$ cells/ mm^3 at presentation was really connected to need for ASV, the development of AKI haemodialysis blood or blood product transfusion and ventilatory support, with odds ratios of 21.89, 21.33, 17.02, 3.79 and 23.42 respectively. Significant associations with the same parameters were observed at 6, 12 and 24 hours. At 6 hours the corresponding odds ratios were 141.38, 74.0, 59.83, 7.38 and 71.87, respectively. Significant associations were also observed at 12 and 24 hours. These data would suggest that serial measurements of TLC may offer prognostic value in the determination of the severity of envenomation.

These results are consistent with previous reports of the correlation of leukocytosis and severity of snake envenomation. Elbey *et al.* found that inflammatory parameters based on leukocyte counts at admission may be connected to complications, and Elawady *et al.* also noted a greater severity of snake envenomation in patients with higher leukocyte counts. Santoro *et al.* also found a lot higher WBC counts in patients with more severe envenomation by Bothrops ^[9-15]. Together, these previous findings confirm the possible utility of leukocytosis as an early marker of envenomation system effects.

A significant finding was that 22 patients were administered ASV when their TLC was $11,000$ cells/ mm^3 or less on all four readings. While some showed signs of oedema and cellulitis, others had coagulopathy or symptoms of neurotoxic envenomation. This shows that a normal TLC does not automatically rule out some minimum level of significant envenomation, and decisions over ASV administration should remain first and foremost clinical and laboratory evidence based.

Overall, the present study has indicated that TLC >11,000 cells/ mm³ and in particular when increased at presentation and throughout follow-up, is connected to a greater number of clinically significant complications. Serial TLC testing is a cost-effective, easy, and accessible test that can be used to and as an adjunct in early risk ranking for the subsequent need for close monitoring for snakebite. Yet, as a nonspecific test and as this was a retrospective case series with relatively few complication events, it should not be used in isolation as a criterion for ASV dosing decisions. Further, prospective studies with larger sample sizes are needed to confirm its independent prognostic significance.

CONCLUSIONS

In this prospective observational study of 400 snakebite patients, high TLC (>11,000 cells/mm³) was significantly associated with ASV requirement, AKI, haemodialysis, blood or blood product transfusion, and ventilatory support at presentation and at 6, 12, and 24 hours. Serial TLC may therefore serve as an inexpensive, readily available adjunct for early risk stratification and monitoring of snake envenomation. However, normal or unchanged TLC does not exclude clinically significant envenomation or the need for ASV; treatment decisions should remain based on clinical and laboratory evidence. Serial TLC estimation, particularly at presentation, may help identify patients at higher risk of complications, allowing closer observation and earlier supportive management. Larger prospective studies are needed to validate its prognostic accuracy and determine its role alongside established clinical and laboratory assessment.

CONTRIBUTION OF AUTHORS

Research concept- Mariya Davis Paracka, Sujith JS

Research design- MaSujith JS, Arundas H

Supervision- Mariya Davis Paracka, Sujith JS, Arundas H

Materials- Mariya Davis Paracka, Sujith JS, Arundas H

Data collection- Mariya Davis Paracka, Sujith JS

Data analysis and interpretation- Sujith JS, Arundas H

Literature search- Mariya Davis Paracka, Sujith JS, Arundas H

Writing article- Sujith JS, Arundas H

Critical review- Sujith JS, Arundas H

Article editing- Mariya Davis Paracka, Sujith JS, Arundas H

Final approval- Sujith JS, Arundas H

REFERENCES

- [1] Kasturiratne A, Wickremasinghe AR, de Silva N, Gunawardena NK, Pathmeswaran A, Premaratna R, et al. The global burden of snakebite: a literature analysis and modelling based on regional estimates of envenoming and deaths. *PLoS Med.*, 2008; 5(11): e218.
- [2] Ministry of Health & Family Welfare, Government of India. Standard Treatment Guidelines: Management of Snake Bite. Quick Reference Guide. New Delhi: Ministry of Health & Family Welfare; 2016.
- [3] Warrell DA. Snake bite. *Lancet*, 2010; 375: 77-88. doi: 10.1016/S0140-6736(09)61754-2.
- [4] Cook D, Zumla AL. *Manson's Tropical Diseases*. 22nd ed. Elsevier; 2008. Available at: <https://shop.elsevier.com/books/mansons-tropical-diseases/cook/978-1-4160-4470-3>.
- [5] Görmeli Kurt N. The importance of neutrophil lymphocyte ratio (NLR) and platelet lymphocyte ratio (PLR) for prognosis and hospitalization period in case of snakebites. *Eurasian J Med Investig.*, 2018.
- [6] Gutiérrez JM, Williams D, Fan HW, Warrell DA. Snakebite envenoming from a global perspective: towards an integrated approach. *Toxicon.*, 2010; 56(7): 1223-35.
- [7] Kumar KS, Narayanan S, Udayabhaskaran V, Thulaseedharan N. Clinical and epidemiologic profile and predictors of outcome of poisonous snake bites: an analysis of 1,500 cases from a tertiary care center in Malabar, North Kerala, India. *Int J Gen Med.*, 2018; 11: 209-16.
- [8] Elawady EH, Tawfik HM. Evaluation of the early prognostic value of neutrophil-lymphocyte ratio (NLR) and platelet-lymphocyte ratio (PLR) in snakebite poisoned patients. *Egypt J Forensic Sci Appl Toxicol.*, 2019; 16(Suppl): 1-16.
- [9] Gupta A, Bhatnagar T, Murthy BN. Epidemiological profile and management of snakebite cases: a cross sectional study from Himachal Pradesh, India. *Clin Epidemiol Glob Health*, 2015; 3(Suppl): S96-100.
- [10] Bhalla G, Mhaskar D, Agarwal A. A study of clinical profile of snake bite at a tertiary care centre. *Toxicol Int.*, 2014; 21(2): 203-08.
- [11] B.R. H. A study on the clinico-epidemiological profile and the outcome of snake bite victims in a tertiary care centre in Southern India. *J Clin Diagn Res.*, 2013.



- [12]Warrell DA, Davidson NMCD, Greenwood BM, Ormerod LD, Pope HM, Watkins BJ, et al. Poisoning by bites of the saw-scaled or carpet viper (*Echis carinatus*) in Nigeria. *Q J Med.*, 1977; 46(181): 33-62.
- [13]Chaudhari TS, Patil TB, Paithankar MM, Gulhane RV, Patil MB. Predictors of mortality in patients of poisonous snake bite: experience from a tertiary care hospital in Central India. *Int J Crit Illn Inj Sci.*, 2014; 4(2): 101-07.
- [14]Elbey B, Baykal B, Yazgan Ü, Zengin Y. The prognostic value of the neutrophil/lymphocyte ratio in patients with snake bites for clinical outcomes and complications. *Saudi J Biol Sci.*, 2015; 24.
- [15]Santoro ML, Sano-Martins IS, Fan HW, Cardoso JLC, Theakston RDG, Warrell DA. Haematological evaluation of patients bitten by the jararaca, *Bothrops jararaca*, in Brazil. *Toxicon.*, 2008; 51(8): 1440-48.

Open Access Policy:

Authors/Contributors are responsible for originality, contents, correct references, and ethical issues. IJLSSR publishes all articles under Creative Commons Attribution- Non-Commercial 4.0 International License (CC BY-NC). <https://creativecommons.org/licenses/by-nc/4.0/legalcode>

