

Original Research Article

Clinical profile and outcome of snakebites in children: a retrospective study from a tertiary hospital in North-East Nigeria

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ABSTRACT

Background: Snake bite envenomation constitutes a medical emergency that affect various organs and tissues, contingents upon the species responsible for the bite. It still remains a public health concern in Sub-Saharan Africa and children are particularly at risk due to their smaller stature, outdoor activities, and delayed presentation to hospitals. This study aims to describe the epidemiology, clinical characteristics and outcome of snake bites in children, in a tertiary hospital in Yola Northeastern Nigeria.

Methods: This was a three-year descriptive retrospective study of all cases of snake bites in children admitted at the Emergency Paediatrics Unit of Modibbo Adama University Teaching Hospital Yola. Demographic and clinical data were collected from patient records and analysed using SPSS version 24.

Results: Out of 3,606 children admitted in the emergency unit, 37 were cases of snake bites giving prevalence of 1%. The ratio of males to females in this study was 2.4:1, with a mean age $\pm$ SD of 10.1 ± 3.2 years. The lower limb is the most common site of bite in 26 (70.3%) patients and the highest prevalence of bite occurred between June and August. Characteristics of envenomation comprised local swelling 37 (100%), pain 23 (62.2%) and prolonged bleeding 17 (45.9%). Two of the patients died, giving a case fatality rate of 5.4%.

Conclusions: Our study reveals distinct patterns of snakebites in children, predominantly affecting adolescent male and high rate of envenomation. Prompt identification of snakebite and medical intervention remains a crucial factor in improving outcomes and reducing mortality.

Keywords: Snakebite, Envenomation, Retrospective, Outcome

INTRODUCTION

Snake bite envenomation constitutes a medical emergency that impacts different organs and tissues in the body, contingent upon the species responsible for the bite.¹ According to the World Health Organization, about 5.4 million snake bites occur annually, 2.7 million are venomous, resulting in a fatality rate of 5%, which equates to 137,880 deaths annually.² The majority of these snakebites take place in Asia, Latin America and Africa. In Asia, it is estimated that up to two million

individuals are bitten by venomous snakes every year, whereas in Africa, the annual number of snake bites requiring treatment is estimated to be between 435,000 and 580,000.²

In Nigeria, snakebites continue to pose a significant and prevalent issue, particularly in rural regions where the availability of timely and effective treatment is restricted. A previous study conducted in the savannah region of Northern Nigeria indicated an annual incidence rate of 497 per 100,000 individuals and a mortality rate of 12.2%

associated with snakebites.³ The three venomous snake species, namely the carpet viper (*Echis ocellatus*), puff adder (*Bitis arietans*) and the black-necked spitting cobra (*Naja nigricollis*), which are part of the Viperidae and Elapidae families, are the primary snakes linked to envenoming incidents in Nigeria.⁴

The majority of victims of snake bites are children or young agricultural workers, many of whom endure physical or psychological effects from envenoming for the remainder of their lives. The impact on poor and vulnerable rural residents, represents not only a significant health issue but also a substantial barrier to economic prosperity due to income loss resulting from initial incapacitation, hospital care, long-term deformities or disabilities and deaths.⁵ The tropical climate, along with the environmental conditions in our region, is known for offering an appropriate habitat for snakes. Furthermore, our community is predominantly agrarian, with a significant portion of its population involved in farming and livestock husbandry.^{6,7}

Children are more susceptible to snakebite envenomation than adults due to various factors. Their natural curiosity, coupled with a lack of situational awareness and behavioral regulation heightens their risk of encountering snakebite incidents. Additionally, children face a heightened risk of envenomation from snake bites due to their increased venom to body mass ratio compared to adults.⁸ Considering the distinct physiological susceptibilities of children and the prevalence of snakebites in Northern Nigeria, it is essential to comprehend the clinical characteristics of snake bites in this region. Consequently, this research was undertaken to examine the clinical profile and outcome of snakebite envenomation in children at our tertiary institution.

METHODS

Study area

This study was conducted at Modibbo Adama University Teaching Hospital (MAUTH), a tertiary hospital located in Yola, North-eastern Nigeria. The area experiences a tropical climate, which is defined by distinct wet and dry seasons. The dry season persists for five months, spanning from November to March, while the rainy season lasts from April to October.⁹

The hospital has a total bed capacity of 500. It is the one of the main referral centers in the Northeast and caters for patients from both within and outside the State. The hospital offers specialists clinical services, research and training for nurses, house officers and resident doctors. The hospital also has different emergency units for management of emergency cases, these includes emergency paediatric unit for children aged one month to 17 years and the accident and emergency unit for adult patients.

Study design and study population

This was a descriptive retrospective study involving children admitted with snake bite at the emergency pediatrics unit of MAUTH over a three-year period (January 2020 to December 2022).

Inclusion criteria

All children aged one month to 17 years with history of snake bite, with or without identification of the snake but presenting within the defined study period, with adequately documented medical records containing key variables such as demographics, clinical features, treatment, and outcomes were included in the study.

Exclusion criteria.

Cases of snake bite outside the age definition for the study, or if the diagnosis was changed during the course of treatment or cases with incomplete medical records were excluded from the study.

Ethical consideration

Ethical clearance was obtained from the Health Research and Ethics Committee (HREC) of MAUTH, before the commencement of the study.

Data collection

The hospital's admission registers were obtained from the medical records department and utilized to identify all patients who were admitted at the emergency pediatrics unit during the study period with a diagnosis of snake bite. The patients case folders were retrieved, and general information such as age, gender, and the duration of the snake bite were extracted and recorded in a study proforma. Additional clinical information gathered from the case records comprised the site of the bite, characteristics of envenomation, treatment administered during hospitalization, the use of polyvalent anti-snake venom, and the treatment outcome.

Statistical analysis

The data retrieved were recorded in Microsoft Excel spreadsheet and transferred entered into SPSS version 24 for analysis. Analysis was mainly descriptive. Bar charts and proportions were used to summarize nominal data, while means, standard deviation and frequency tables were used to illustrate quantitative data.

RESULTS

General characteristics of patients

During the period of the study, there were 3606 admissions, out of which 37 were cases of snake bite, giving a prevalence rate of 1%. Twenty-six (70.3%) were

males and 11 (29.7%) were females giving a male: female ratio of 2.4:1. Majority of the children were more than 10 years (59.5%) and the mean age of the study population was 10.1 ± 3.2 years (Table 1).

Table 1: General characteristics of patients.

Characteristics	Frequency	%
Age group (years)	N	
4-7	8	21.6
8-9	7	18.9
≥ 10	22	59.5
Mean age $\pm$ SD	10.1 $\pm$ 3.2 years	
Mean weight $\pm$ SD	26.1 $\pm$ 9.1 kg	
Gender		
Male	26	70.3
Female	11	29.7

Table 2: Clinical characteristics and outcomes of snakebites.

Characteristics	Frequency	%
Site of bite		
Right leg	10	27.0
Left leg	9	24.3
Right hand	6	16.2
Left hand	4	10.8
Left foot	4	10.8
Right foot	3	8.2
Left arm	1	2.7
Lower limb	26	70.3
Upper limb	11	29.7
Nature of envenomation		
Systemic	30	81.1
Local	7	18.9
Mean PCV $\pm$ SD	29.7 $\pm$ 9.0 %	
Received blood transfusion		
Yes	10	27.0
No	27	73.0
PASV - anti-snake venom		
Yes	26	70.3
No	11	29.7
Outcome		
Died	2	5.4
Survived	35	94.6

Clinical characteristics and outcomes of patients

The most common site for snake bite among our study population was the lower limb 26 (70.3%) and the upper limb 11 (29.7%). With regards to envenomation, 30 (80.1%) showed features of systemic envenomation while 7 (18.9%) had local envenomation. Ten (27%) had blood transfusion during the course of management, while 26 (70.3%) of the study population receive polyvalent anti snake venom (PASV) (Table 2).

Monthly distribution of snake bite cases

Figure 1 showed the monthly distribution of the snake bites, with August being the highest 7 (18.9%), closely followed by June and July with each having frequency of 6 (16.2%). The months of January 1 (2.7%), November 2 (5.4%) and December 2 (5.4%) had the least frequencies with January being the lowest.

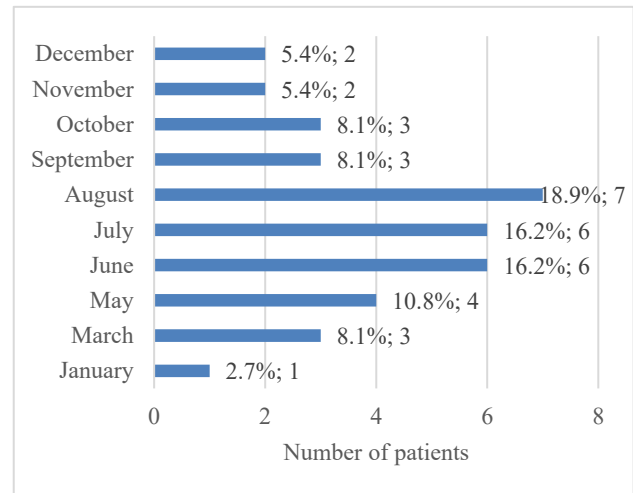


Figure 1: Monthly distribution of snake bite cases.

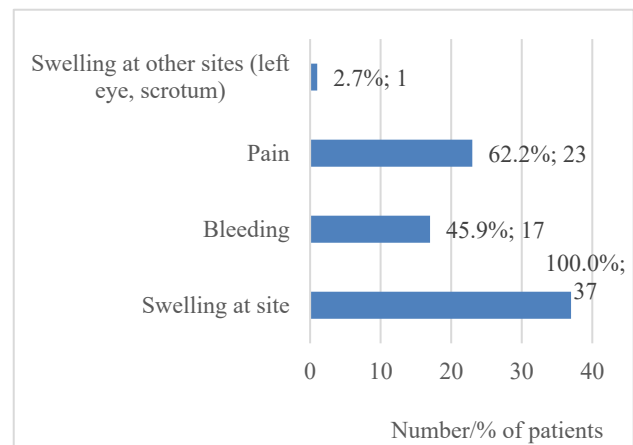


Figure 2: Characteristic of envenomation.

Characteristic of envenomation

Figure 2 shows that the most common feature of envenomation is swelling at site of bite 37 (100%), while pain and bleeding from site were 23 (62.2%) and 17 (45.9%) respectively.

DISCUSSION

The prevalence of snake bite over the three-year period of this study was found to be 1%, this is similar to 0.25% and 0.15% reported in Southeastern and Northwestern part of Nigeria respectively.^{10,11} These hospital-based prevalence may not reflect the true burden of snake bite

in our societies. The reason for this is that in our societies, similar to many African societies, the treatment for snake bites is frequently obtained from traditional healers.^{6,12} A study in Nigeria revealed that only 8.5% of snake bite victim sought for treatment in the hospitals.¹³

In this study, the male to female ratio of the patients is approximately 2.4:1. This is similar to reports from Sokoto in Nigeria and India studies, with both having male to female ratios of 1.6:1.^{11,14} This finding indicates that males are twice more likely to be bitten by snakes compared females. This may be attributed to the fact that males are more adventurous, resulting in the likelihood of higher frequency of encounters with snakes.

The mean age of patients in this study population is 10.1 years, with almost 60% of the patients aged 10 years and above. This is similar to mean age of 12.4 and 9.6 in Southeast and Northwestern Nigeria respectively.^{10,11} The predominance of adolescent males in these studies may be ascribed to the observation that adolescents are more inclined to engage, alongside adults, in occupational activities like farming that may predispose them to risk of snake bites.¹³

This study showed a predominance of the lower limbs (70%) as the most common site of bites, this finding is consistent with other studies; Ndu et al (69.3%) (70.8%), Karunanayake et al (73%), Kshirsaga et al (74%) and Suganthi et al (85%).^{10,15-17} The consistency of this observation may stem from the fact that individuals frequently come across snakes while walking, especially in areas with tall grass or vegetations where snakes can blend in. Numerous bites can occur when people inadvertently step on or provoke snakes, with the lower limbs being the most susceptible point of contact.

It is observed in this study that majority of the snake bites took place during the rainy season, peaking during the months of June to August. This coincides with the beginning of farming activities in the region, along with a wet environment and the presence of grasses that provide shelter for the snakes and other reptiles. Farming activities during the rainy season increases the chances of human encounters with snakes. These finding collaborate with the reports by Ndu et al and Nduagubam et al who in an earlier study reported mores cases of snake bite in the rainy season.^{10,18}

All the children in this develop local or systemic envenomation complications following snake bites. Local edema was seen in all cases, other features of envenomation seen in this study is bleeding and pain. This pattern of envenomation was reported in similar in Nigerian studies suggesting similarity of the snake species residing in the regions.^{4,10,11} This differs from the findings of Kshirsagar et al in India, where neurological manifestations such as diplopia and respiratory distress were more frequent.¹⁴ This contrast may be ascribed to differences in the dominant snake species, the

characteristics of their venom, and the variations in clinical presentation observed in different regions.

PASV was prescribed for all patients in this study, however only 70% received PASV during the course of treatment. This is similar to findings by Sani et al in Sokoto, Nigeria, where 80% of the patients received PASV.¹¹ This could due to the fact that PASV is very expensive making it unaffordable to most patients with snake bites in our region.

There were two cases of death giving a mortality of 5.4% in this study population, this finding is similar to the outcome of a study in Northern Nigeria¹⁹ which reported mortality of 5.7%, but lower compared to other similar studies in Southern Nigeria (7.7%)¹⁰ and other countries like India (11.1% and 9.9%) and Sri Lanka (11%).^{16,17,20} However, some studies in Nigeria and United States of America recorded zero mortalities.^{11,13,21} The differences in mortality rates observed in various studies may indicate disparities in healthcare access, the timing of interventions, and the species of venomous snakes that are most common in these regions. The outcome can be critical for patients who present late; therefore, early diagnosis, suitable treatment, and vigilant monitoring of children for the emergence of complications, along with their timely management, can be life-saving.

This study is limited by its retrospective design and reliance on hospital records, which may be incomplete and the snake species were not identified by the caregivers or victims. These limitations can be addressed in future prospective studies.

CONCLUSION

Snake bites is still a public health concern in sub-Saharan Africa. This study describes the distinctive clinical pattern of snake bite in children showing a high-rate envenomation. Early identification of snakebite and medical intervention remains a crucial factor in improving outcomes and reducing mortality.

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REFERENCES

- Warrell DA. Snake bite. *The Lancet*. 2010 Jan 2;375(9708):77–88.
- World Health Organization. Snakebite envenoming. World Health Organization. 2019. Available at: <https://www.who.int/news-room/fact-sheets/detail/snakebite-envenoming>. Accessed on 3 June 2026.
- Chippaux J. Estimate of the burden of snakebites in sub-Saharan Africa: A meta-analytic approach. *Toxicon*. 2011;57:586–99.
- Habib AG. Venomous snakes and snake envenomation in Nigeria. In: Gopalakrishnakone P, Faiz A, Fernando R, Gnanathanan C, Habib A, Yang C, editors. *Toxinology: Clinical Toxinology in Asia Pacific and Africa*. Springer Netherlands; 2015;275–98.
- Harrison RA, Hargreaves A, Wagstaff SC, Faragher B, Laloo DG. Snake envenoming: A disease of poverty. *PLoS Negl Trop Dis*. 2009;3(12).
- Habib AG, Abubakar SB. Factors affecting snakebite mortality in north-eastern Nigeria. *Int Health*. 2011;3(1):50–5.
- Ofemile Y, Major M, Ajagun. E, Suleiman M, Kawu M, Shittu M, et al. Snakes Responsible for Bites in Norths-Eastern Nigeria-A Hospital Based Survey. *IOSR J Environ Sci Toxicol Food Technol*. 2015;9(9):118–21.
- Orlandi G, Rossi N, Chiarelli F, Di Filippo P. Vipera Snakebite in Children: A Focus on Europe. *Children*. MDPI; 2025;12
- Adebayo AA, Zemba AA, Adebayo AA, Zemba AA, Ray HH, Dayya SV. Climate Change in Adamawa State, Nigeria: Evidence From Agro Climatic Parameters. *Adamawa State University Journal of Scientific Research*. 2012;2(2):1–8.
- Ndu I, Edelu B, Ekwochi U. Snakebites in a Nigerian children Population: A 5-year review. *Sahel Medical Journal*. 2018;21(4):204.
- Sani U, Jiya N, Ibitoye P, Ahmad M. Presentation and outcome of snake bite among children in Sokoto, North-Western Nigeria. *Sahel Medical Journal*. 2013;16(4):148.
- Snow RW, Bronzan R, Roques T, Nyaimawi C, Murphy S, Marsh K. The prevalence and morbidity of snake bite and treatment-seeking behaviour among a rural Kenyan population. *Ann Trop Med Parasitol*. 1994;88(6):665–71.
- Omogbai EKI, Nworgu ZAM, Imhafidon MA, Ikpeme AA, Ojo DO, Nwako CN. Snake bites in Nigeria: A study of the prevalence and treatment in Benin City. *Tropical J Pharma Res*. 2002;1(1):39–44.
- Kshirsagar VY, Ahmed M, Colaco SM. Clinical profile of snake bite in children in rural India. *Iran J Pediatr*. 2013;23(6):632–6.
- Ogunfowokan O. Bite-to-hospital time and morbidity in victims of viper bite in a rural hospital in Nigeria. *Afr J Prim Health Care Fam Med*. 2012;4(1).
- Karunanayake RK, Dissanayake DMR, Karunanayake AL. A study of snake bite among children presenting to a paediatric ward in the main Teaching Hospital of North Central Province of Sri Lanka. *BMC Res Notes*. 2014;7(1):1.
- Suganthi V, Santhi K, Nandhini S. Clinico-epidemiological profile of snake bite in children in a tertiary care hospital, South India. *Original Research Article Pediatric Review: International Journal of Pediatric Research*. 2018;5(4):196–202.
- Nduagubam OC, Chime OH, Ndu IK, Bisi-Onyemaechi A, Eke CB, Amadi OF, et al. Snakebite in children in Nigeria: A comparison of the first aid treatment measures with the world health organization's guidelines for management of snakebite in Africa. *Ann Afr Med*. 2020;19(3):182–7.
- Idoko A, Ikwueke K. Snakebite in the tropics: experience in Makurdi, Nigeria. *Trop Geogr Med*. 1984;36(2):175–80.
- Muniyapillai T, Maniprabhu S, Abinaya R, Kulothungan K, Thirunavukkarasu S, George N, Kulothungan Sr K. Clinical profile and outcomes of pediatric snakebite envenomation: a three-year retrospective study from a rural tertiary care center in South India. *Cureus*. 2024;16(11).
- LoVecchio F, Debus DM. Snakebite envenomation in children: A 10-year retrospective review. *Wilderness Environ Med*. 2001;12(3):184–9.

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