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Original Research Article

# Study of Clinical Profile and Outcome of Snake Bites in Children Attending a Tertiary Care Hospital

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**Abstract**

**Background:** Snakebite is an important medical emergency and public-health problem in tropical and subtropical regions. Children are particularly vulnerable to severe envenomation because the same absolute venom dose may produce greater systemic exposure in a smaller body mass. Early recognition, appropriate supportive care, timely administration of anti-snake venom (ASV) when indicated, and access to definitive care are central to reducing morbidity and mortality.

**Objective:** To describe the clinical and hospital profile and outcomes of children presenting with snakebite to a tertiary-care hospital and to assess the temporal distribution of cases and recorded treatment and outcome patterns.

**Methods:** A retrospective observational study was conducted at Gauhati Medical College & Hospital, Guwahati, Assam. Hospital snakebite records covering the period from July 2022 to July 2026 were reviewed. The available register contained month-wise numbers of pediatric snakebite cases and entries relating to P/A, DOR, DAMA/LAMA, referral and ASV administration. Monthly and annual frequencies were summarized descriptively. The study had Institutional Ethics Committee approval from Gauhati Medical College & Hospital; the proposal was approved at the IEC meeting held on 29 June 2022.

**Results:** A total of 128 pediatric snakebite cases were recorded during the available observation period. Annual case numbers were 1 in 2022, 3 in 2023, 41 in 2024, 55 in 2025 and 28 during January–July 2026. The highest monthly number of cases was recorded in July 2025 (10 cases), followed by June 2025 (9 cases) and July 2026 (9 cases). ASV administration was explicitly recorded in six monthly entries: one case in March 2024, two in May 2024, one in April 2025 and one in July 2025; an additional ASV entry in the August 2025 row was also recorded.

**Conclusion:** Pediatric snakebite constituted a recurrent emergency presentation at the study hospital, with marked variation in case occurrence over time and an apparent increase in recorded cases during 2024–2025 compared with the earlier part of the register. The findings emphasize the importance of systematic pediatric snakebite surveillance, standardized documentation of clinical manifestations and outcomes, and timely access to appropriate snakebite management.

**Keywords:** Snakebite; Snake Envenomation; Children; Pediatric Emergency; Anti-Snake Venom; Outcome; Tertiary Care Hospital; Assam; India.

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## Introduction

Snakebite envenoming is a potentially fatal medical emergency and a major neglected tropical disease, particularly in rural and resource-poor communities. It can cause neurological paralysis, coagulopathy and bleeding, acute kidney injury, shock, tissue injury and permanent disability. Children are a particularly vulnerable population as venom exposure relative to body mass may be greater than in adults and severe systemic effects may develop rapidly. India accounts for a large proportion of the global burden of snakebite mortality. A nationally representative survey of mortality estimated around 45,900 snakebite deaths per year in India during the study period, with deaths occurring predominantly in rural areas, and with strong seasonal variation. This constant burden has led to national and international efforts to improve prevention, access to antivenoms, health

care preparedness and standardized management. Snakebite in children has special clinical and prognostic implications. Previous Indian studies have shown significant heterogeneity in clinical presentations, with predominantly hemotoxic or neurotoxic syndromes based on geographical location and local snake fauna. In this Indian Pediatric series, most bites took place in July-September and mortality was related to delayed presentation to hospital. In a similar prospective study of 110 children with snake envenomation, younger age, prolonged walking after the bite and anemia were also important factors associated with poor outcome.

Studies from eastern India have also highlighted the continuing burden on children. In the retrospective study from Odisha most of the pediatric cases were reported during rainy season with predominance of lower-limb bites and clinically important complications like acute kidney injury, shock and coagulation abnormalities. More recent Indian pediatric studies have shown continued substantial morbidity and mortality associated with delayed treatment, renal complications and respiratory paralysis.

However, despite this evidence there exists relatively limited institution-specific data on the burden and outcomes of pediatric snakebite in Northeast India. Hospital-based data are important in understanding patterns of presentation, ASV utilization and outcomes at a local level, and in identifying areas where documentation and emergency preparedness can be strengthened.

Hence, the present study was carried out to describe the clinical/hospital profile and outcomes of snakebite among children attending a tertiary-care hospital with special emphasis on the temporal distribution of cases and recorded treatment and outcome patterns.

**Objectives**

**Primary Objective**: To study the clinical profile and outcomes of snakebite in children attending a tertiary-care hospital.

**Secondary Objectives**

1. To determine the frequency and temporal distribution of pediatric snakebite cases.
2. To describe recorded ASV utilization.
3. To describe the recorded hospital outcomes of pediatric snakebite cases.
4. To identify temporal patterns that may assist institutional preparedness for pediatric snakebite management.

**Experimental and analytical methods**

**Design of the study**

This was a retrospective, observational, hospital-based study.

**Setting of the study:** The study was done at Gauhati Medical College & Hospital (GMCH), Guwahati, Assam, India, a tertiary-care teaching hospital.

The Institutional Ethics Committee documentation indicates the study institution as Gauhati Medical College & Hospital and mentions approval of the study proposal titled Study of Clinical Profile and Outcome of Snake Bites in Children Attending a Tertiary Care Hospital.

**Period of study:** The hospital register available was from July 2022 to July 2026. The 2026 data in the register were through July and thus constitute a partial calendar year.

**Study Population:** The study population was children with documented snakebite presenting to the study hospital during the observation period.

The register provided is an aggregate monthly record and not an individual patient level database.

Hence, demographic and detailed clinical variables, which were not available in the register, were not imputed.

**Data Source and Variables:** Data were taken from the available hospital snakebite register. The record states:

- Month, year;
- The total number of cases;
- P/A;
- DOR;
- DAMA/LAMA;
- referred cases; and
- ASV administration.

**Statistical Analysis:** The data were summarized using descriptive statistics and entered in tabular form in an organized manner.

The following were evaluated:

- Total number of cases;
- Number of cases per year;
- Monthly case rate;
- •annual time trends;
- ASV administration documented; and
- Recorded hospital outcome categories where these were unambiguous.

Results are presented as frequencies and percentages where the determinant and category definition were relatively clear. The data provided were aggregated at the month level and did not include complete clinical variables at the individual level, so we did not perform inferential statistical analysis and multivariable modeling.

**Ethical considerations:** The study was approved by the Institutional Ethics Committee, Gauhati Medical College & Hospital.

The approval document states that the proposal was approved at the IEC meeting of 29 June 2022. It also requires prior committee approval for amendment to the approved proposal and change in protocol or informed-consent documents.

## Results

**Overall burden:** A total of 128 pediatric snakebite cases were recorded in the supplied register between July 2022 and July 2026. The annual distribution demonstrated substantial variation over the observation period.

**Table 1: Annual distribution of recorded pediatric snakebite cases**

| Year | Period represented | Number of cases | Percentage of total |
|---|---|---|---|
| 2022 | July–August | 1 | 0.8% |
| 2023 | September–December | 3 | 2.3% |
| 2024 | January–December | 41 | 32.0% |
| 2025 | January–December | 55 | 43.0% |
| 2026 | January–July | 28 | 21.9% |
| **Total** | **July 2022–July 2026** | **128** | **100%** |

The apparent increase in 2024 and 2025 should be interpreted in the context of the incomplete earlier period represented in the register and should not automatically be interpreted as an epidemiological increase in incidence.

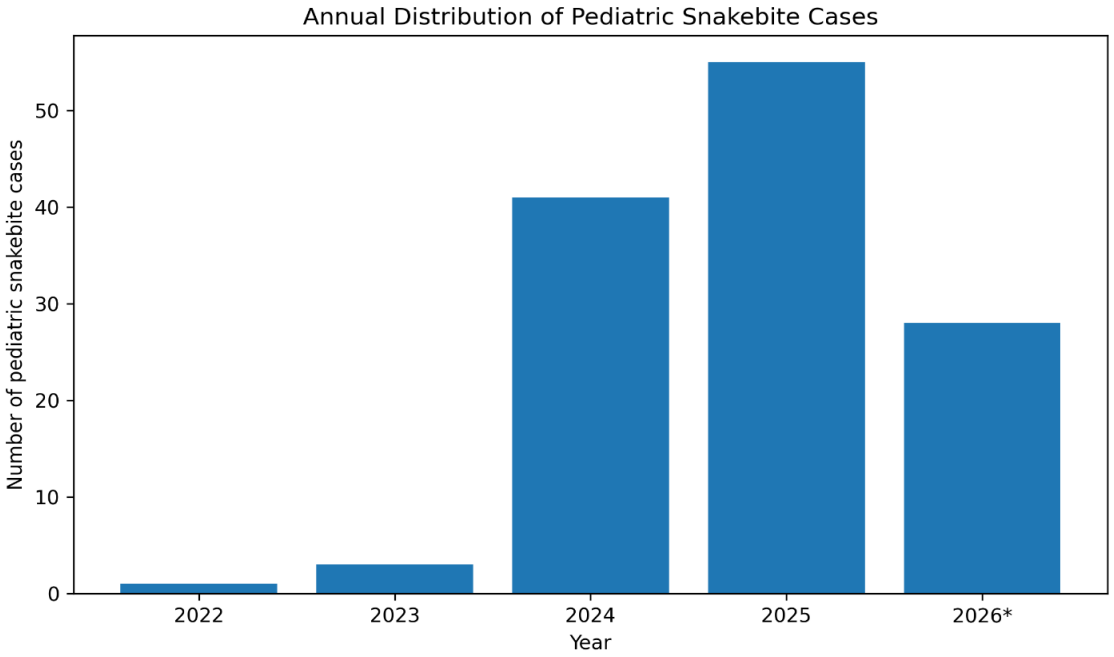



**Figure 1: Annual distribution of pediatric snakebite cases from the available hospital register, July 2022–July 2026.**

**Monthly distribution:** Case occurrence varied considerably across months. The largest monthly case count was recorded in July 2025 (10 cases). This was followed by June 2025 (9 cases) and July 2026 (9 cases). Eight cases were recorded in August 2024 and May 2026.

**Table 2: Month-wise distribution of recorded pediatric snakebite cases**

| Month/year | Total cases |
|---|---|
| July 2022 | 1 |
| August 2022 | 0 |
| September 2023 | 0 |
| October 2023 | 3 |
| November 2023 | 0 |
| December 2023 | 0 |
| January 2024 | 0 |
| February 2024 | 0 |

| | |
|---|---|
| March 2024 | 4 |
| April 2024 | 1 |
| May 2024 | 5 |
| June 2024 | 5 |
| July 2024 | 3 |
| August 2024 | 8 |
| September 2024 | 6 |
| October 2024 | 5 |
| November 2024 | 3 |
| December 2024 | 1 |
| January 2025 | 1 |
| February 2025 | 0 |
| March 2025 | 1 |
| April 2025 | 6 |
| May 2025 | 2 |
| June 2025 | 9 |
| July 2025 | 10 |
| August 2025 | 5 |
| September 2025 | 6 |
| October 2025 | 7 |
| November 2025 | 5 |
| December 2025 | 3 |
| January 2026 | 1 |
| February 2026 | 3 |
| March 2026 | 2 |
| April 2026 | 0 |
| May 2026 | 8 |
| June 2026 | 5 |
| July 2026 | 9 |
| **Total** | **128** |

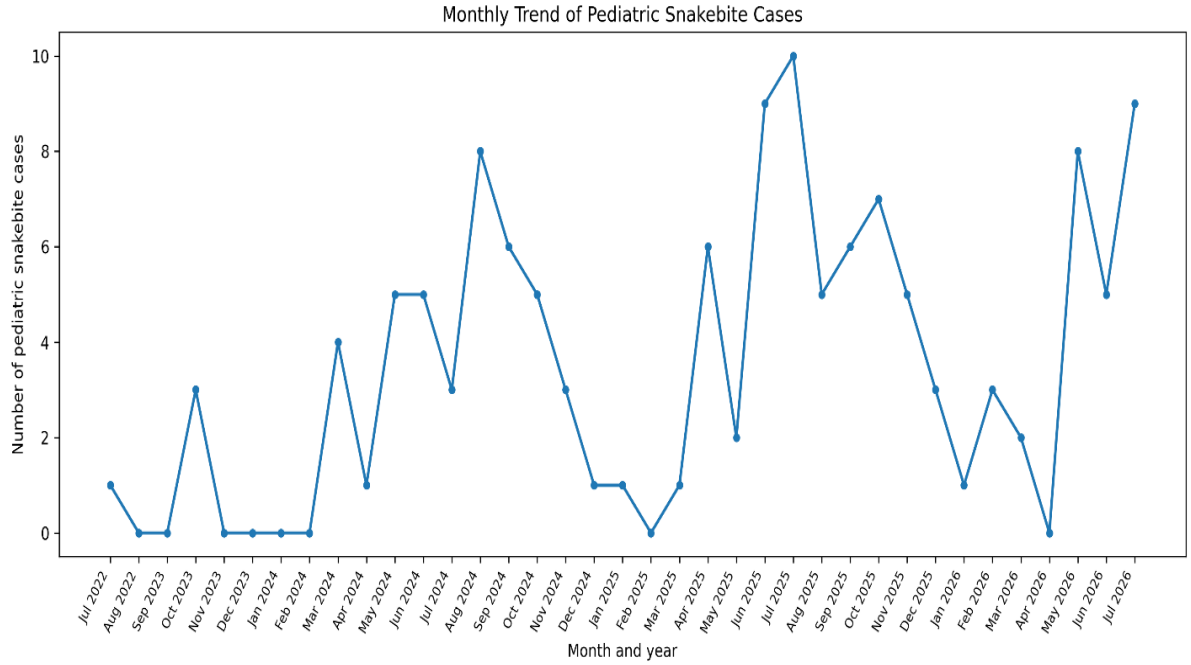



**Figure 2: Monthly trend in pediatric snakebite presentations from July 2022 to July 2026.**

A line graph should plot month/year on the X-axis and number of cases on the Y-axis.

**Hospital disposition:** Among the recorded dispositions, D/A (Discharge with Advice) was the most frequently documented category, with 107

clearly identifiable entries across the available monthly register.

DAMA/LAMA was documented in selected months, including June 2024, November 2024, June 2025 and May 2026. DOR was documented in several entries during 2025 and 2026.

In July 2025, the register recorded 10 cases, of which 6 were documented as D/A and 3 under DOR, with an additional handwritten "death-1" annotation. In August 2025, 5 cases were recorded, with 4 documented as D/A and an "absconded-1" annotation. September 2025 recorded 6 cases, including 5 D/A and 1 DOR. The June 2025 entry requires particular attention because 9 cases were recorded, while 4 were documented as D/A and the register contains both DAMA-1 and LAMA-1 annotations. Thus, some patient dispositions cannot be completely reconciled from the aggregate register alone.

**Anti-snake venom administration:** ASV administration was recorded in selected monthly entries.

From the supplied register, clearly identifiable ASV entries included:

- March 2024: 1 case;
- May 2024: 2 cases;
- April 2025: 1 case;
- July 2025: 1 case; and
- August 2025: 1 case.

Thus, at least six ASV administrations are explicitly identifiable from the Study.

**Table 3: Clearly identifiable ASV entries**

| Month/year | Total cases | Recorded ASV |
|---|---|---|
| March 2024 | 4 | 1 |
| May 2024 | 5 | 2 |
| April 2025 | 6 | 1 |
| July 2025 | 10 | 1 |
| August 2025 | 5 | 1 |
| **Clearly identifiable total** | — | **6** |

These figures represent recorded ASV entries in the supplied register, rather than a definitive patient-level ASV rate. The latter requires reconciliation against individual case records and confirmation that blank cells represent "no ASV" rather than missing documentation.

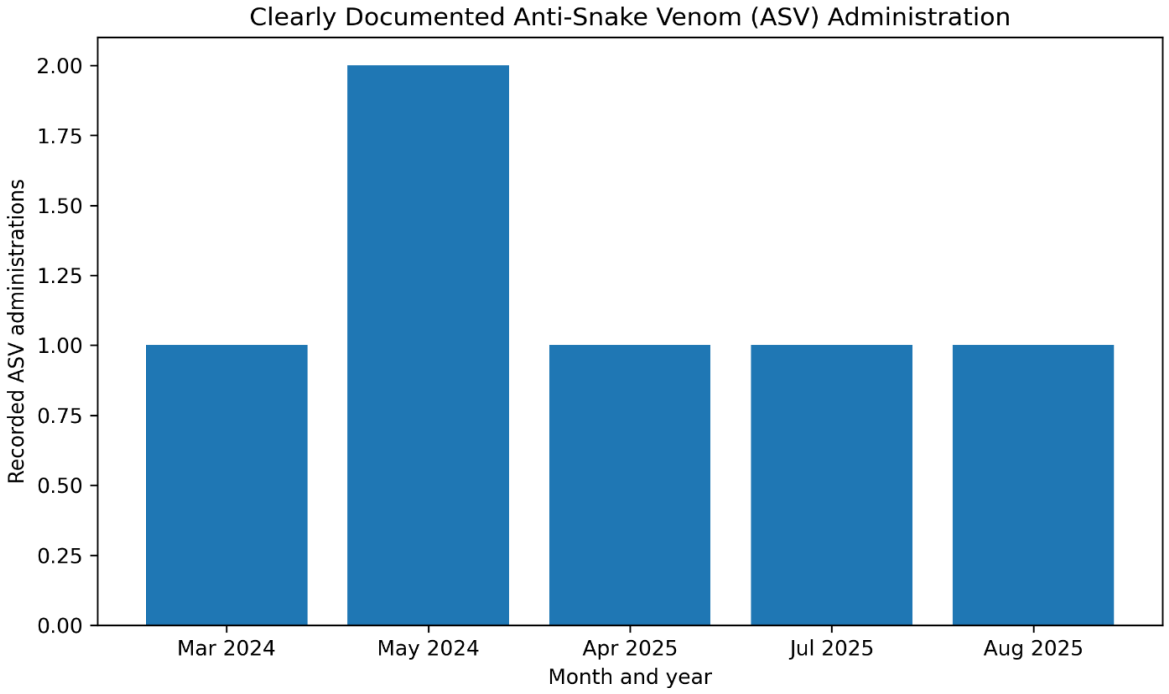



**Figure 3: Clearly documented ASV administration by month during the study period.**

**Table 4: Recorded outcome fields requiring source verification**

| Disposition/outcome | Recorded cases | Interpretation |
|---|---|---|
| D/A – Discharge with Advice | 107 | Clearly recorded D/A entries |
| DOR | Requires final source reconciliation | Recorded in selected entries |
| DAMA/LAMA | At least 5 clearly identifiable | Recorded in selected entries |
| Referred | At least 1 clearly identifiable | Referral recorded in selected entry |
| Death annotation | Present in selected record | Requires case-level verification |
| Absconded annotation | Present in selected record | Requires case-level verification |

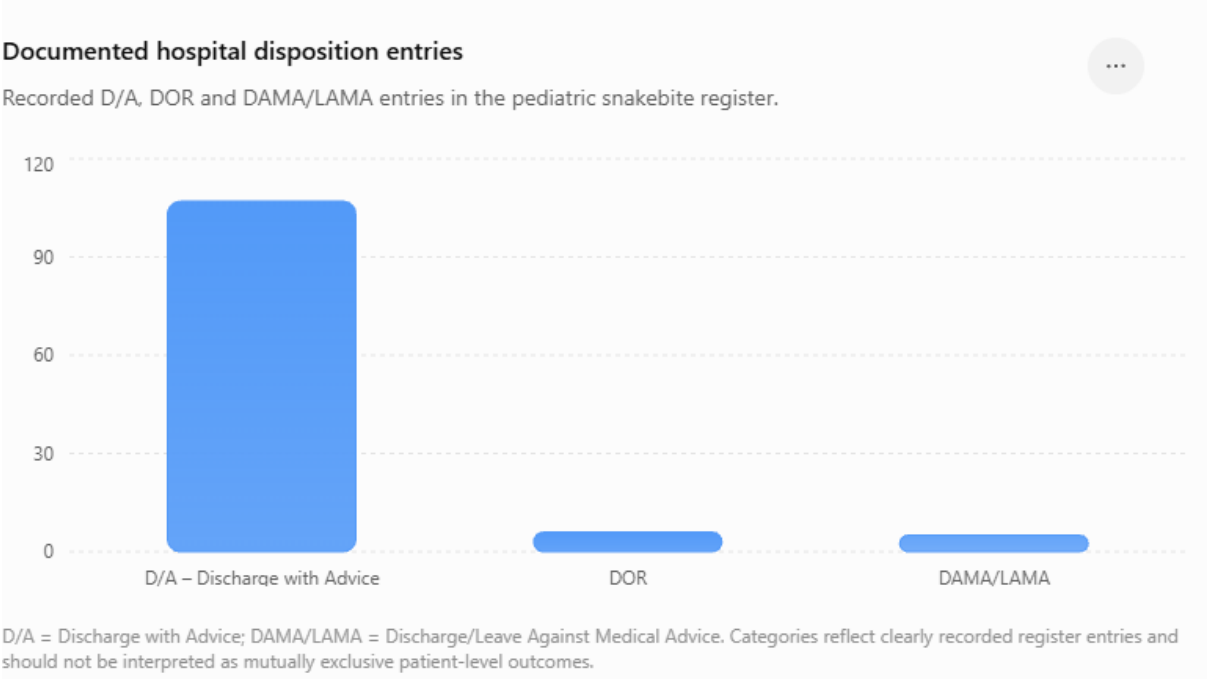



**Figure 4: Distribution of documented hospital disposition entries among pediatric snakebite cases.**

Month-wise D/A, DOR and DAMA/LAMA Table

**Table 5: Month-wise recorded hospital disposition**

| Month/Year | Total cases | D/A | DOR | DAMA/LAMA |
|---|---|---|---|---|
| July 2022 | 1 | 1 | 0 | 0 |
| August 2022 | 0 | 0 | 0 | 0 |
| September 2023 | 0 | 0 | 0 | 0 |
| October 2023 | 3 | 2 | 0 | 0 |
| November 2023 | 0 | 0 | 0 | 0 |
| December 2023 | 0 | 0 | 0 | 0 |
| January 2024 | 0 | 0 | 0 | 0 |
| February 2024 | 0 | 0 | 0 | 0 |
| March 2024 | 4 | 4 | 0 | 0 |
| April 2024 | 1 | 1 | 0 | 0 |
| May 2024 | 5 | 5 | 0 | 0 |
| June 2024 | 5 | 4 | 0 | 1 |
| July 2024 | 3 | 3 | 0 | 0 |
| August 2024 | 8 | 7 | 0 | 0 |
| September 2024 | 6 | 6 | 0 | 0 |
| October 2024 | 5 | 5 | 0 | 0 |
| November 2024 | 3 | 2 | 0 | 1 |
| December 2024 | 1 | 1 | 0 | 0 |
| January 2025 | 1 | 1 | 0 | 0 |
| February 2025 | 0 | 0 | 0 | 0 |
| March 2025 | 1 | 1 | 0 | 0 |
| April 2025 | 6 | 6 | 0 | 0 |
| May 2025 | 2 | 2 | 0 | 0 |

| | | | | |
|---|---|---|---|---|
| June 2025 | 9 | 4 | 0 | 2* |
| July 2025 | 10 | 6 | 3 | 0 |
| August 2025 | 5 | 4 | 1† | 0 |
| September 2025 | 6 | 5 | 1 | 0 |
| October 2025 | 7 | 7 | 0 | 0 |
| November 2025 | 5 | 5 | 0 | 0 |
| December 2025 | 3 | 3 | 0 | 0 |
| January 2026 | 1 | 1 | 0 | 0 |
| February 2026 | 3 | 3 | 0 | 0 |
| March 2026 | 2 | 2 | 1‡ | 0 |
| April 2026 | 0 | 0 | 0 | 0 |
| May 2026 | 8 | 7 | 0 | 1 |
| June 2026 | 5 | 5 | 0 | 0 |
| July 2026 | 9 | 9 | 0 | 0 |

**Discussion**

We report pediatric snakebite cases from a tertiary-care hospital in Assam for the available period between July 2022 and July 2026. The main finding was the recording of 128 pediatric snakebite cases with significant temporal variation, reaching the highest annual number in 2025. The highest number of cases in a month was in July 2025.

Snakebite continues to be a major public-health problem in India, disproportionately affecting rural populations and exhibiting marked seasonality.

The pattern seen in the present hospital register, especially the increased number of presentations during few months in the mid to later part of the observation period, is in agreement with the seasonal variation observed in previous Indian pediatric studies. Kshirsagar et al. reported >50% of presentations of pediatric snakebite in rural Maharashtra during July–September. Similarly, a study from eastern India reported that approximately 60% of pediatric bites were from July to September.

However, the temporal pattern observed in our study should not be interpreted as a population incidence trend. The earliest register available starts mid-2022, with only selected months in 2023. 2024 and 2025 have full years entered. In addition, the study is based on hospital presentations rather than community surveillance. Differences in healthcare seeking behavior, referral patterns, documentation and hospital utilization may thus influence the observed distribution.

The number of pediatric snakebite cases increased markedly in the register in 2024 and 2025 compared with the limited observation period of 2022-2023. The greatest monthly burden was in July 2025. This observation is clinically relevant for hospital preparedness because periods of greater snakebite presentation may require sufficient availability of ASV, trained personnel, monitoring facilities and pediatric emergency support. Clinical management of snakebite is based on the recognition of envenomation and the development of local or systemic manifestations, not solely on the history of a bite. The WHO guidelines stress on rational use of antivenom and appropriate supportive care. Indian management recommendations also stress clinical indications for ASV and not indiscriminate use. The current register records ASV administration in selected cases, but does not contain individual clinical indications, dose, timing, and adverse reactions in the aggregate dataset provided. Therefore, the study cannot determine whether ASV was appropriately indicated, or whether treatment was administered in a timely fashion.

This is important because antivenom administration itself calls for careful clinical judgment. Indian studies have reported adverse reactions to ASV including clinically significant reactions in pediatric patients. Thus, future prospective documentation at the study institution should include indication for ASV, time from bite to treatment, number of vials administered, response to treatment and adverse reactions.

Previous studies in pediatric patients have shown that outcome is dependent on severity and type of envenomation, as well as delay in appropriate treatment. In a prospective Indian pediatric cohort, younger age, longer walking after the bite and anemia were associated with poor outcome. Similarly, a recent South Indian pediatric tertiary-care study reported associations between mortality and delayed antivenom administration, renal failure and respiratory paralysis. These observations emphasize the importance of early recognition, prompt referral and standardized emergency management.

The available register contains the outcome-related fields DOR, DAMA/LAMA and referral. However, the meaning of DOR is not defined, and the handwritten annotations cannot be reconciled with confidence to the total numbers of cases, and so this study deliberately does not report an unverified

mortality rate. This is a key methodological strength: outcome estimates should be derived from validated definitions and not inferred from unclear handwritten abbreviations.

The results also point to a significant opportunity for improvement in hospital documentation. A standardized pediatric snakebite proforma should record age, sex, residential setting, date and time of bite, site of bite, suspected snake species if known, time from bite to hospital presentation, local manifestations, neurological manifestations, bleeding manifestations, renal involvement, coagulation findings, indication for ASV, dose and timing, supportive interventions, complications, duration of hospitalization and final outcome. This structured documentation would enable future examination of the predictors of morbidity and mortality.

**Clinical Implications**

The present findings have a number of practical implications.

First, the fact that snakebite occurs repeatedly in children suggests that institutions need to be prepared all the time and not at specific times of the year.

Second, planning for ASV stocks, pediatric monitoring capacity, and emergency staffing should anticipate periods of increased presentations.

Third, early referral and definitive management are crucial. Delay in treatment and severe systemic manifestations have been shown to be associated with poorer outcome in pediatric studies.

Fourth, there is a need for standard documentation. The present register provides a sufficient representation of the general disease burden but does not allow for a reliable analysis of several clinically relevant variables.

Finally, the hospital-based findings should be seen in the wider national snakebite-control context. India's national response is increasingly focused on prevention, access to effective antivenom, and strengthening of health systems and surveillance.

**Strengths**

The study has several strengths:

1. It is a review of snakebite cases in children from a tertiary-care hospital.
2. The register is for a number of years.
3. Information month-wise helps to assess temporal variation.
4. Hospital register contained fields related to treatment and outcome.
5. The study was approved by the Institutional Ethics Committee.
6. The study identifies important deficiencies in aggregate documentation that can guide future prospective data collection.

**Limitations**

There are a few caveats to consider.

First, this was a retrospective, single center study based on a hospital register. Thus, the results cannot be directly extrapolated to snakebite incidence in the community.

Second, the available register is aggregated per month and not per patient. Thus, it is not possible to establish relationships between clinical characteristics, treatment and outcomes.

Third, the register provided does not contain demographic variables such as age and sex and detailed clinical variables such as bite site, snake species, clinical syndrome, laboratory abnormalities, time to presentation and complications.

Fourth, there are a number of abbreviations in the manuscript which are not defined. In particular, the meaning of P/A and DOR needs to be confirmed from the original study protocol or case-record form.

Fifth, some outcome annotations are not clearly reconciled to monthly totals. Therefore, definitive mortality, referral and DAMA/LAMA percentages are not to be calculated from the present aggregate source without verification against the original records.

**Conclusion**

Pediatric snakebite is an important emergency presentation at the study tertiary-care hospital with 128 cases registered in the available register from July 2022 through July 2026. The number of monthly presentations varied widely, with the highest monthly burden being in July 2025. The available records, as well, demonstrate documented use of ASV in selected cases.

These findings support the need for ongoing institutional preparedness, prompt recognition and management of envenomation, appropriate access to ASV, and early referral when necessary.

Most importantly, the study emphasizes the need for standardized individual level documentation of pediatric snakebite including clinical manifestations, timing of treatment, ASV dosage, complications and clearly defined outcomes. There is a need for prospective multi-centric studies that include these variables to identify the determinants of morbidity and mortality among children with snakebite in Northeast India.

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