Original Article

Clinical, laboratory profile and outcomes in children with snakebite from Eastern India

Biswajit Pattanaik, Chinmaya Mahapatra, Karthika IK, Amit K. Satapathy, Joseph John, Rashmi R. Das, Bhagirathi Dwibedi, Samarendra Mahapatro, Krishna M. Gulla

Departments of Paediatrics, All India Institute of Medical Sciences, Bhubaneswar, Odisha, India

Abstract

Background: Snakebite remains a significant public health problem worldwide, particularly in rural areas with unexpected morbidity and mortality. This study evaluated the clinical, laboratory profile and outcomes in children with snake bites from Eastern India. **Methods:** This was a retrospective case record-based study between January 2017 and December 2021. The clinical features, complications, laboratory profiles and outcomes were analysed. **Results:** Thirty children with snake bites were admitted during this study period. There was a male predominance with a ratio of 2.3:1. The mean age of presentation was 10.4 years. About 60% of bites occurred during the rainy season between July and September. Most bites (96%) were on lower limbs, predominantly showing vasculotoxic features followed by neurotoxic and a combined presentation. In this study, around 53% received anti-snake venom (ASV) before reaching our centre; the median time to reach our centre was 13 h. Complications such as acute kidney injury (AKI), cellulitis, shock and coagulation abnormalities were common in those who arrived early (before 6 h) than in those who reached late (after 6 h). Similarly, the mean duration of hospital stay was less for those seeking medical attention early as compared to those reaching late for treatment (4.7 days vs. 7.2 days). Twenty-six out of 30 (86.7%) were discharged without any sequelae, 3 (10%) children were left against medical advice and one died. **Conclusions:** Snakebite remains a major health problem in children causing significant morbidity and mortality. Children, in general, especially males, are particularly vulnerable because of their playful and explorative nature and considerable time spent in outdoor activities. Preventive measures, education about avoiding traditional first aid methods and early administration of ASV reduce complications, duration of hospital stay and avoid the use of antibiotics.

Keywords: Anti-snake venom, children, outcome, snake bite

Introduction

The World Health Organisation (WHO) estimates that 81,000–138,000 people die yearly from snakebites worldwide. The number of people who survive after a snake bite is thrice the number of people who die; however, many are left with disabilities or amputations.[1] India contributes to approximately half of the global snakebite deaths.[1] As per a nationally representative mortality study in 2020, 70% of deaths in India occurred in eight states: Bihar, Jharkhand, Madhya Pradesh, Odisha, Uttar Pradesh, Telangana, Rajasthan and Gujarat.[1] The estimated number of snakebite deaths in thousands from 2000 to 2019 in India in children aged 0–14 years was 149 in males and 176 in females.[1] The decline in the age-specific snakebite death rate was the fastest for children aged 0–14 years (declining by about 1.6% annually).[2] Elapidae and Viperidae are responsible for most snake bite envenomations. The primary species of venomous snakes in India are Russell's viper, Krait, the Indian

Address for correspondence: Dr. Krishna M. Gulla, Department of Pediatrics, AIIMS, Bhubaneswar, Odisha - 751 019, India.
E-mail: ped_krishna@aiimsbhubaneswar.edu.in

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cobra and the saw-scaled viper. In India, haemotoxicity is described with viperine bites and neurotoxicity with elapid bites, whereas bites by Russell's viper cause combined haemotoxicity and neurotoxicity.[3]

A few studies are present on the clinical and laboratory profile of children with snake bites from Eastern India.[2,3] There are no recent studies that describe the outcomes and complications based on the timely interventions including anti-snake venom (ASV) and first aid after snake envenomation. Thus, this study was undertaken to describe the epidemiology, clinical features, complications, laboratory profile and treatment outcomes of children with snake bites, considering the time point from envenomation to receiving first aid, ASV and hospital (primary and referral care) services.

Hence, this study signifies the importance of awareness and services at the primary healthcare facilities as the first point of contact in snake bite management in preventing complications and mortality.

Methodology

Study setting: This study was conducted at the inpatient department (IPD) of paediatrics, All India Institute of Medical Sciences, Bhubaneswar. *Study duration*: January 2017 to December 2022. *Study design*: Retrospective study, and hence formal sample size was not calculated. *Data collection:* The data extraction form was designed to collect demographic details, time, type and site of the bite, kind of snake, the indication of ASV, time to receive first aid and the first dose of ASV, the total quantity of ASV received, adverse events related to ASV administration, clinical features at the time of presentation (local symptoms and signs, haematological and neurological manifestations), laboratory profile (whole blood coagulation time, complete blood count, liver and renal function tests, serum electrolytes), total duration of hospital stay, antibiotic use and treatment outcomes were recorded in the proforma. Descriptive statistics (mean, median and percentage) were used to present the data. *Ethical clearance:* The Institutional Ethics Committee approval was obtained to conduct the study (T/IM-NF/Ped/21/143).

Results

A total of 30 children (28 were poisonous, and 2 were non-poisonous) were admitted to the hospital with snakebite during the study period.

Epidemiological analysis

In 27 cases, the family members could not describe the snake; the remaining three were one each of the Viperine, Cobra and Krait species. The demographic profile of patients is shown in Table 1. The site of the bite was on the lower limb in 29 children and on the upper limb in 1 child. Out of 30, 22 (73.3%) children received first aid, only 16 (53%) children received ASV before admission to our hospital, and 7 children received it after admission after assessment. The median time to reach our hospital was 13 (7, 27) h. Twenty-two of the 30 children reached the hospital within 6 h, and 8 children reached later. The seasonal distribution of snake bites is shown in Figure 1.

Indications for referral

Progressive swelling at the bite site in 12 (40%), neurological dysfunction in 5 (16%), gastrointestinal symptoms in 3 (10%), bleeding diathesis in 2 (6%), acute kidney injury (AKI) in 1 (3.3%) and self-referral in 5 (16%) were observed. The laboratory parameters are shown in Table 2.

Analysis related to ASV

The time taken to receive first aid and the first dose of ASV in hours (median, interquartile range [IQR]) were 4 h (4,8) and 8 h (5, 24), respectively (N = 23). The minimum number of ASV vials received before reaching our hospital was 3, and the maximum was 10. The first dose of ASV was given for the following indications (N = 23): neurologic involvement in 6 (26%), swelling of the bite site in 12 (52%), gastrointestinal symptoms in 3 (13%) and bleeding in 2 (8.6%). The second and third doses of ASV were given to 17 (56.6%) and 8 (26.6%) children, respectively. Indications for the 3rd dose of ASV were persisting neurological involvement in two (25%), extended swelling in four (50%) and

Table 1: Demographic profile of children with snakebite (*n*=30)

	Number(%)
Parameter	
Age in years, mean (SD)	10.4 (2.73)
Males (percentage)	21 (70)
Seasonal incidence of snake bite, number (%)	
Summer (March–June)	7 (23)
Monsoon (July–September)	18 (60)
Winter (October–February)	5 (17)
Geographical distribution, number (%)	
Khurda	19 (64)
Nayagarh	6 (20)
Puri	3 (10)
Cuttack	1 (3)
Medinipur	1 (3)

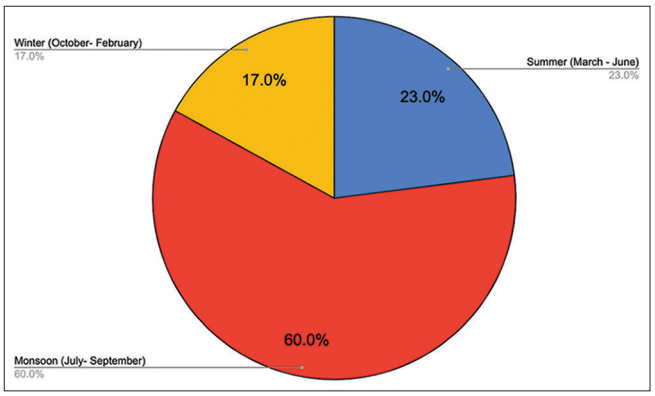

Figure 1: Seasonal incidence of snake bite

haemorrhagic diathesis in two (25%). Among those 23 children who received ASV, the median number of ASV vials received was 15 (10, 20) per patient. Six out of 23 (26%) children who received ASV developed minor adverse events. Premedication with hydrocortisone and pheniramine maleate was given to 12 out of 23 (52%) children who received ASV.

Clinical signs and symptoms

Among neurologic symptoms (N = 5), ptosis was present in all five (100%), drooling of saliva and pooling of secretions in four (80%), weakness of limbs in two (40%), absent gag reflex and paradoxical breathing in two (40%) and mid dilated pupils in one (20%). There were six children with active bleeding, where three (50%) had bleeding from the bite site, three (50%) had haematuria, and two (33%) had bleeding from the nose and mouth. Eleven (36.6%) children had delayed whole blood coagulation time, and the median time for normalising whole blood coagulation time after the first dose of ASV administration was 16 (6, 22) h. Six children (20%) had cellulitis, amongst which three developed compartment syndrome requiring fasciotomy. One child developed cardiogenic shock that resolved within 24 h of ASV administration. Four children (13%) had AKI, and all were managed conservatively.

Differentiation amongst early and late arrival cases to hospital

Among the 22 children who came early, 16 (72%) received ASV, and among 8 children who reached late, 6 (75%) received ASV. Four children (50%) developed AKI, amongst those who reached late. Two children (9%) and four children (50%) developed cellulitis amongst those who reached early and late, respectively. The only child who developed shock had reached late Figure 2. Deranged coagulation profile developed in one child (4.5%) who reached early and four children (50%) who reached late. The mean vials of ASV required were 12 and 19, respectively, amongst those reaching early and late. Antibiotics used were less, 17 (77%) in those who reached early compared to 8 (100%) in those who reached late. The mean duration of hospital stay was 4.7 days in those who reached early and was 7.2 days in those who reached late [Table 3].

Twenty-five out of 30 (83.3%) children received broad-spectrum antibiotics. The median duration of hospital stay was 4 (3.6) days.

Outcomes

Twenty-six children (86.7%) were discharged without any sequelae, 3 (10%) children were discharged against medical advice, and one died (3.3%).

Table 2: Laboratory parameters of children with snakebite at admission

Laboratory parameter, mean (SD)	Value
Prothrombin time	15.3 (6.6)
INR	1.27 (0.57)
APTT	25.22 (9.7)
Blood urea (mg/dL)	31.8 (23)
Serum creatinine (mg/dL)	1.36 (2.0)
Haemoglobin (g/dL)	11.7 (2.0)
Total leukocyte count (/mm^3) Median (IQR)	15,540 (11,500, 24,690)
Platelet count (/mm^3) Median (IQR)	2,81,500 (1,82,000, 3,25,000)
Sodium (mEq/L)	134 (3.9)
Potassium (mEq/L)	4.17 (0.8)
AST (IU/L)	36.5 (30, 50)
ALT (IU/L)	24 (17, 37)
ALP (IU/L)	245 (215, 270)

Table 3: Data of children who reached the hospital early versus late

Parameter	Reached hospital <6 h	Reached hospital >6 h
Children	22	8
Received ASV		
Yes	16	06
No	06	02
Mean vials of ASV received		
1st dose	6 (0–10)	9 (5–10)
2nd dose	4 (0–10)	8 (0–10)
3rd dose	2 (0–10)	4 (0–10)
Total	12 (0–30)	19 (10–30)
The mean duration of hospital stay in days	4.7 (±0.8)	7. 2 (1.5)
Antibiotics used	17 (77%)	8 (100%)
Acute kidney injury	0	4 (50%)
Cellulitis	2 (9%)	4 (50%)
Shock	0	1 (12.5%)
Coagulopathy	1 (4.5%)	4 (50%)

Discussion

Snake envenomation is a significant global public health problem except for a few islands, high altitude and cold environments. In India, about 216 species of snakes are identified, and 52 are reported to be poisonous, constituting about 5% of all injury-related deaths and nearly 0.5% of deaths across ages.[4] Snakebite is a medical emergency where timely intervention can save all lives. Literature on snake envenomation in children is scarce.[5] Children are more prone to severe envenomation and complications due to their larger body surface area, smaller extracellular fluid volume, and less proteins to bind to the circulating venom.[6] Our study found that snake bite was more commonly seen in males with a ratio of 2.3:1, similar to other studies.[3,7,8] This is probably because of more outdoor activities amongst males compared to female children.

In our study, the mean age of children with snakebites was 10.4 years, similar to other studies.[3,9,10] This is a vulnerable age for snake bites as they walk or play around nearby jungles or paddy fields. We also noticed that 60% of snake bites occurred from July to September[11] due to the rainy season when snakes occupy burrows in the soil. Increased human agricultural activity during the rainy season also increases exposure to the snake habitat.

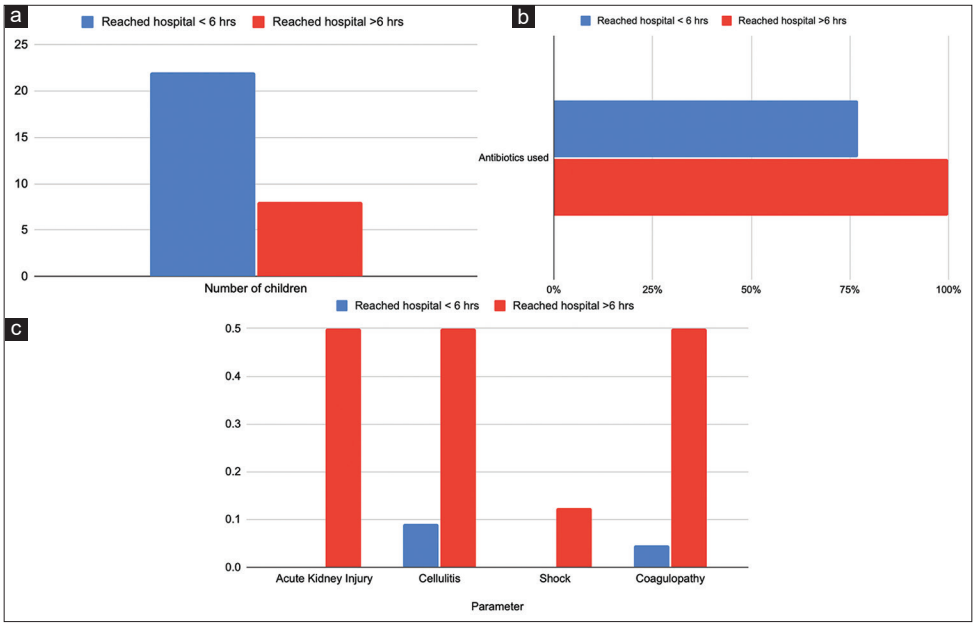

Figure 2: (a–c) Parameters on early vs. late presentation to hospital

Most bites on the lower limb (96%) in our study were similar to other studies[3] due to accidental stepping. Most bites were vasculotoxic, followed by neurotoxic and combined in nature. A similar type of distribution of envenomation was reported from other parts of the country.[2,12] Though cellulitis was the most common local manifestation (40% and 60%) found in other studies,[10,13] we had a lower incidence of the same.

In our study, 16 (53%) children received ASV from other hospitals before being referred to us, and the median time to reach our centre was 13 h. There is a need to improve services for treating snakebites at peripheral hospitals in our region and education for early referral in the absence of adequate services. Four (18%) children received 20 vials and 5 (22%) received around 30 vials of ASV. These high ASV doses were given for persistent neurological symptoms, extensive local swelling and bleeding diathesis. Other studies found that 48.6% of cases were treated with less than 10 vials and only 9.6% received more than 20 vials[14]. A higher percentage of children received 20–30 ASV vials due to delayed referral. Six out of 23 (26%) children who received ASV developed minor adverse events, similar to other studies where 14.2% of patients had adverse reactions without death.[15] The death rate in our study was 3.3%, which was comparable to one study from North India[15] though no deaths have also been reported by others.[16]

Table 3 shows a comparison between patients who presented early and late. Those who reached early before 6 h had fewer complications than children who received treatment after 6 h. Children who came late had complications such as AKI in four children (50%), cellulitis in four children (50%), coagulation abnormality in four children (50%) and shock in one child (12.5%). These complications were less in children who received treatment early. Other studies found similar results: those who received first aid early before 6 h had less mortality than those who received it after 6 h.[17] The antibiotics used were also less in those who reached early than in those who reached late (77% vs. 100%). The mean duration of hospital stay was low in patients seeking attention early within 6 h as compared to those coming late (4.7 days vs. 7.2 days). This finding was similar to other studies.[7] This difference is due to delays in referral and seeking treatment, religious beliefs, and herbal remedies available locally in rural areas before coming to a tertiary care centre.

Strengths and limitations

Our study analyzed the factors that impact the complications and mortality in snake envenomation in children, which are modifiable and non-modifiable, including the timing and dose of ASV administration and the time to reach the hospital. It also depicts the paediatric data of snake envenomation—both clinical-laboratory and epidemiological data from Eastern India.

The limitations include a small sample size and unavailable data on most cases regarding the species of snake bite.

Conclusion

Snakebite remains a major health problem in children causing significant morbidity and mortality. Children are particularly vulnerable because of their playful and explorative nature, and they also spend considerable time in outdoor activities, particularly male children. Simple preventive measures should be taken, and people should be educated about avoiding traditional first aid methods and early presentation to the hospital. Early arrival at the hospital, appropriate treatment, early adequate ASV and close monitoring of children for the development of complications and prompt management can reduce morbidity and mortality.

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Conflicts of interest

There are no conflicts of interest.

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