



SNAKE BITE IN CHILDREN – A HOSPITAL-BASED CROSS-SECTIONAL STUDY IN A TERTIARY CARE HOSPITAL IN EASTERN INDIA

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ABSTRACT **Background**– Snake bite is a neglected issue in our country. It is a potentially life-threatening condition with its incidence being underestimated. Many poisonous snakes are found in this part of the country, most of them being neurotoxic in nature. Despite a large number of morbidities and mortalities every year, very little attention is paid by clinicians in this area. **Objectives** – a) To study the prevalence, epidemiological, demographic and clinical profile of non-poisonous and poisonous snake bites. b) To study the various complications of snake bite and their response to standard treatment in these patients. **Methodology**- It is an institutional-based cross-sectional descriptive study carried out in the Department of Pediatrics, Bankura Sammilani Medical College and Hospital, Bankura, West Bengal, India. All children under 12 years of age admitted in our pediatric ward with an alleged history of snake bite between June 2021 to May 2022 were included in the study after taking informed consent from the guardians of these children. Total 94 patients were included in our study. **Results**- Most of the patients were more than 5 years of age with the mean age being 7.74 years. The incidence of snake bite was more in males (61.70%) as compared to females(38.29%). Cases were more reported from rural areas (84.04%) as compared to urban areas(15.96%). Bites were more common in the lower extremities (74.47%) as compared to upper extremities (25.53%) and between the months of June to August (38.3%). Most patients reported to the hospital within 6 hours of bite (71.3%). Most of them hadn't used any first aid, while rest of them had used a tourniquet or application of herbs or had cut the affected part proximal to the bite before reaching the hospital. 42.55% were non-poisonous bites and 57.45% were poisonous snake bites. Out of the poisonous bites majority (34.05%) were neurotoxic snake bites and 23.40% were vasculotoxic in nature. Among neurotoxic snake bites, ptosis was the predominant symptom and among vasculotoxic snakebites, cellulitis and oliguria were the predominant symptoms. ASV was administered in 57.45% patients. Around 18.08% patients required invasive ventilation and 23.4% required non-invasive ventilatory support. Eventually 94.68% patients were discharged successfully and the remaining patients were discharged with complications or were referred to a higher centre. There was no mortality due to snake bite during the study period. **Conclusion**- Snake bite victims who were brought to our hospital early had an excellent prognosis in our study. Awareness about the necessity of early medical attention needed in cases of snake bites can reduce the complications and mortality arising out of them.

KEYWORDS : ASV, Neurotoxic, Snake Bite, Vasculotoxic

INTRODUCTION

Snake bite is a neglected issue in many tropical and subtropical countries. It is a major public health problem in rural India. Due to inadequate epidemiological data, the incidence of snake bites is underestimated. According to WHO, though the exact number of snake bites is unknown, an estimated 5.4 million people are bitten each year with up to 2.7 million envenomings. Around 81,000 to 138,000 people die each year because of snake bites, and around three times as many amputations and other permanent disabilities are caused by snake bites annually. Agricultural workers and children are the most affected. Children often suffer more severe effects than adults, due to their smaller body mass [1].

There are nearly 300 snake species that inhabit the varying habitats across the country, of which more than 60 are venomous and about 180 non-venomous. The species fall under four families – Colubridae, Elapidae, Hydrophiidae, and Viperidae [2]. In India, four species of venomous snakes are responsible for most cases of snake bites and are fondly known as the “big four”. They are the spectacled cobra (*Naja naja*), common krait (*Bungarus caeruleus*), saw-scaled viper (*Echis carinatus*), and Russell's viper (*Daboia russelii*).

Children owing to their smaller size and lower volume of distribution often present with more severe effects of snake bite which include rapid and severe neurotoxicity, coagulopathy, and severe local tissue damage. An estimated quarter of bites from venomous snakes are 'dry' bites meaning that venom is not injected and envenomation does not occur. [3] As snakes are natural inhabitants near the forest areas, most cases of snake bites happen in rural areas. Snake bites usually occur when humans move closer to the habitat of snakes like paddy fields, tea or coffee plantations, bushes for open field defecation, or beside the water bodies. Bites may be inflicted at home by peri-domestic species

which live either in the roof space or under the floor like cobras and common kraits. The seasonal peak of snakebites is mostly seen during the rainy and summer season.

Snake venoms contain mixtures of enzymes, polypeptides, glycoproteins, and other constituents. Vascular leakage with bleeding occurs due to the presence of hemorrhagins in snake venom. Proteolytic enzymes cause local tissue necrosis, affect the coagulation pathway at various steps, and impair organ function. Neurotoxins act either pre-or post synaptically to block transmission at the neuromuscular junction, causing muscle paralysis.

It is important to recommend the most effective first aid for victims to enable them to reach the nearest medical facility in the best possible condition. The recommended protocol for India as per National Protocol -2017 goes by the acronym of “CARRY IT R.I.G.H.T.”

The incorrect use of tourniquets causes a risk of ischemia and loss of limb with an increased risk of necrosis. Cutting and suctioning might increase the risk of severe bleeding as clotting mechanisms might be deranged and it also increases the risk of infection.

Polyvalent anti-venom serum is effective against the bites of the Big Four – cobra, saw-scaled viper, common krait, Russell's viper. Timely administration of anti-snake venom (ASV) along supportive management is the only effective treatment available for snake bites with poisonous envenomation. ASV is most effective when administered early enough to neutralize the venom in the circulation before reaching the target site.

MATERIALS AND METHODS

Study design-

It is an Institutional-based cross-sectional descriptive study.

Study Area – Department of Pediatrics, Bankura Sammilani Medical College and Hospital, Bankura, West Bengal, India

Study Population– 94 cases of snake bite envenomation in children under 12 years of age who were admitted in our pediatric ward with a history or clinical features suggestive of alleged snake bite during the study period.

Study Period– From 1st June 2021 to 31st May 2022

METHODS -

After obtaining informed and written consent, data were collected using a pre-designed, pretested structured questionnaire by interviewing the study subjects or their legal guardians who were hospitalized during the study period. Detailed information about their epidemiological and demographic parameters was obtained and the time interval to reach the hospital after snake bite and the type of first aid received were ascertained. A thorough physical examination was carried out to look for features of local or systemic toxicity. A 20 min whole blood clotting test was performed in all children to rule out vasculotoxic envenomation. Patients with serious symptoms were shifted to PICU and were monitored closely.

Anti-snake venom was administered to all children showing features of local or systemic envenomation. In children with features of suspected neurotoxic envenomation, drugs such as Inj. Atropine, Inj. Neostigmine, Inj. Calcium gluconate was given as and when required. IV antibiotics were added as and when required. The patients were monitored closely for evidence of airway compromise and progressive paralysis. In patients with suspicion of vasculotoxic snake bite, urine output and renal parameters were closely monitored to look for evidence of acute kidney injury.

Subsequently, data was collected and analysed with SPSS version 25. P value <0.05 was considered significant.

RESULTS

A total of 94 patients were admitted with an alleged history of snake bites in our pediatric ward, 58 (61.70%) were males and 36 (38.29%) were females. (Fig. 1)

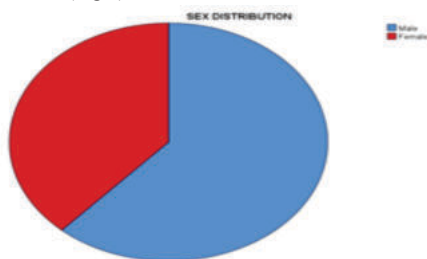


Fig. 1 showing the sex distribution of snake bite

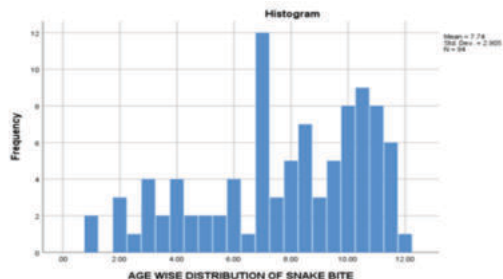


Fig. 2 showing the age-wise distribution of snake bite (in years)

The patients belonged to various age groups, most of them being between 6-12 years of age with the mean age being 7.74 years (Fig. 2).

Out of 94 cases of snakebite, 40 (42.55%) were non-poisonous bites and 54 (57.45%) were poisonous snake bites. Out of the poisonous bites, 32 (34.05%) were neurotoxic snake bites and 22 (23.40%) were vasculotoxic snake bites. Around 71.3% patients could seek medical attention in less than 6 hours of snake bite while 28.7% patients arrived after 6 hours of snake bite. (Table 1)

TYPE	No. of cases	Percentage
Non-poisonous	40	42.55%
Neurotoxic	32	34.05%
Vasculotoxic	22	23.40%
Total	94	100%

Interval	No. of cases	Percentage
Less than 6 hours	67	71.3%
More than 6 hours	27	28.7%
Total	94	100%

LOCALITY	No. of cases	Percentage
RURAL	79	84.04%
URBAN	15	15.96%
Total	94	100%

79 (84.04%) of the patients resided in rural areas and 15 (15.96%) of them resided in urban areas. (Table 2).

Most snakebites were commonly seen on the lower extremity 70 (74.47%) compared to the upper extremity 24 (25.53%). Cases of snake bites occurred mostly in the months of June 2021 to August 2021 (38.3%) followed by the month of March 2022 to May 2022 (35.1%) (Tables 3 and 4)

Site of bite	Poisonous bites		Non-poisonous bites	
	Number	Percentage	Number	Percentage
Upper extremity	13	13.83%	11	11.70%
Lower extremity	41	43.62%	29	30.85%
Any other body part	0	0%	0	0%
Total (N=94)	54	57.45%	40	42.55%

Time of snakebite	No. of snakebite cases	% of snakebite cases
June 2021- Aug 2021	36	38.3
Sep 2021 – Nov 2021	18	19.1
Dec 2021 - Feb 2022	7	7.5
Mar 2022 – May 2022	33	35.1
(N=94)		100.0

Based on the type of first aid received, the patients were categorized and 48 (51.06%) of them received no first aid which comprised the majority, followed by 19 (20.21%) patients who had presented with a tourniquet applied on the affected part, 15 (15.96%) patients had local herbs applied on the affected site and 12 (12.77%) had a cutproximal to the site of the bite. (Table 5)

Type of first aid used	Number of patients (N=94)	Percentage
No first aid	48	51.06%
Tourniquet application	19	20.21%
Cutting proximal to the bite site	12	12.77%
Application of local herbs	15	15.96%
Total	94	100%

Children presented with varied local and systemic signs and symptoms of snake bite depending on the type of snake bite. Amongst local signs and symptoms, pain at the site of the bite was experienced by 48 (51.06%) of the patients, followed by no local signs in 34 (36.17%), cellulitis in 16 (17.02%), and local bleed in 13 (13.83%) patients. Amongst the neurotoxic snake bites, almost all patients (96.88%) had ptosis at the time of presentation and 81.25% of them had ophthalmoplegia followed by dysphagia in 65.62% of patients and impending respiratory failure in 53.12% patients. 25% patients of with neurotoxic snakebite were unconscious at the time of admission. Amongst the vasculotoxic bites, 54.55% of patients had oliguria, 18.18% had features of acute renal failure, 13.64% had haematuria and 9.10% patients had gum bleed or epistaxis. (Table 6)

Local Signs	Non-Poisonous Bites(N=40)	Vasculotoxic Bites(N=22)	Neurotoxic Bites (N=32)	Total (N=94)
a) Pain	11	21	16	48 (51.06%)
b)Local Bleed	6	4	3	13 (13.83%)
c) Cellulitis	2	14	0	16 (17.02%)

d)No Local Signs	21	0	13	34 (36.17%)
SYSTEMIC SYMPTOMS OF NEUROTOXIC SNAKE BITE(N=32)				
Symptoms	No. of cases	Percentage		
Loss of consciousness	8	25.00%		
Ptosis	31	96.88%		
Dysphagia	21	65.62%		
Ophthalmoplegia	26	81.25%		
Impending respiratory paralysis	17	53.12%		
SYSTEMIC SYMPTOMS OF VASCULOTOXIC SNAKE BITE(N=22)				
Symptoms	No. of cases	Percentage		
Hematuria	3	13.64%		
Oliguria	12	54.55%		
Acute renal failure	4	18.18%		
Gum bleed or epistaxis	2	9.10%		

Total 54 (57.45%) patients received ASV(anti snake venom). 48 (51.07%) of them had received 30 vials AVS, 4 (4.26%) of them had received 20 vials AVS and 2 (2.12%) of them received 10 vials AVS each. 40(42.55%) patients did not receive ASV in our study. (Table 7). Anticholinesterase therapy with Inj. Neostigmine along with Inj. Atropine was administered to patients with neurotoxic symptoms of snake bite as and when required.

Total number of ASV administered	No. of cases (N=94)	Percentage of cases (%)
Not received	40	42.55%
10 vials	2	2.12%
20 vials	4	4.26%
30 vials	48	51.07%

Out of the total 94 patients, 17 (18.08%) of them required invasive mechanical ventilation and 22 (23.40%) patients needed non-invasive ventilation. (Table 8) After completion of treatment, 89 (94.68%) patients were discharged successfully without any complications and 3 (3.20%) patients were discharged with complications like local soft tissue swelling and gangrenous changes at the bite area and 2 patients (2.12%) with acute renal failure had to be referred to higher center for further management. There were no deaths due to snakebite during our study period. (Table 9)

Type Of Assisted Ventilation	Number (percentage)
Invasive ventilation	17 (18.08%)
Non-Invasive ventilation	22 (23.40%)

Outcome	NUMBER (PERCENTAGE)
Discharged successfully	89 (94.68%)
Discharged with complications	3 (3.20%)
Referred to higher centre	2 (2.12%)
Deaths	0 (0%)

DISCUSSION

Total 94 patients were admitted to our hospital during the study period with snake bite. Out of them, 58 (61.70%) were males and 36 (38.29%) were females which clearly showed a male preponderance of snakebite. In similar studies, the incidence was more in boys as compared to girls which can be attributed to their behaviour and nature to play more outdoor games. [4,5,6,7]

Most of the patients were between 6 to 12 years which was in concordance with other studies which showed that the highest "at-risk" group comprised prepubescent boys. [6]

79 (84.04%) of patients lived in rural areas which gave us an indication of a higher incidence of snake bites amongst children living in rural areas which also happen to be the natural habitat of most snakes. Similar results were reported in other studies. [5,16]

Our study showed that most of the cases of snakebite happened between the months of June 2021 to August 2021 (38.3%) followed by the month of March 2022 to May 2022 (35.1%). During this season snakes come out of their shelter because of increased humidity and warmth. This seasonal pattern of snakebite was also reported in other studies as well. [7,11,12,13]

The lower extremities were the most common site of snake bite in our study (70.47%). Similar observations have been made in other studies [4,8,9]. It might be owing to the fact that the lower extremities are easily accessed by the snakes while a person walks on the ground.

Around 51.06% of patients in our study did not use any first aid measure, though 20.21% had applied a tourniquet, 12.77% had cut the affected site proximal to the bite and 15.96% patients had applied local medicinal herbs to the affected area. In the study done by Karunanayake RK [8], tourniquet application and native treatment were done as pre-hospital treatment in 16% of children. This could be due to the lack of awareness amongst the rural people about the disadvantages of these methods and the easy accessibility of the aforesaid measures. Also due to the non-availability of transport specially during night hours, the primary health centre is not approachable which makes the people use these methods.

The most common type of poisonous snake bite in our area was neurotoxic 34.05% followed by vasculotoxic 23.40%. This is in contrast with other studies which have showed a higher incidence of vasculotoxic snake bites as compared to neurotoxic snake bites. [4,10,14]. This can be due to the fact that neurotoxic snakes like krait are a very important cause of snake bites in this part of the country.

Amongst local signs and symptoms, pain at the site of the bite was experienced by 51.06% of the patients, followed by no local signs in 36.17% cases, cellulitis in 17.02% cases, and local bleed in 13.83% of patients. Similar findings were noted in other studies [4,7].

Amongst the neurotoxic snake bites, almost all patients 96.88% had ptosis at the time of presentation and 81.25% of them had ophthalmoplegia followed by dysphagia in 65.62% of patients and impending respiratory failure in 53.12% patients and 25% patients were unconscious at the time of admission. Amongst the vasculotoxic bites, 54.55% of patients had oliguria, 18.18% had features of acute renal failure, 13.64% had hematuria and 9.10% patients had gum bleed or epistaxis. 2 patients with acute renal failure were referred to a higher centre for haemodialysis. Similar complications were noted in other studies as well. [15,17,18].

Patients with poisonous snake bites received ASV (anti snake venom). 51.07% of all patients had received 30 vials AVS, 4.26% had received 20 vials AVS and 2.12% received 10 vials AVS each. 42.55% patients did not receive ASV in our study. We had used lower dose of anti snake venom in our study to treat the patients. [20] Anticholinesterase therapy was administered to patients with neurotoxic symptoms of snake bite as and when required. Out of the total 94 patients, 18.08% of them required invasive mechanical ventilation and 23.40% of patients needed non-invasive ventilation. Hence assisted ventilation plays an important role in the management of patients with snakebites, specially in those with impending respiratory failure. Ready availability and appropriate use of anti-snake venom, close monitoring of patients, and timely institution of ventilatory support helped in reducing the mortality. [5]

After completion of treatment, 89 (94.68%) patients were discharged successfully without any complications and 3(3.2%) patients were discharged with complications like local gangrenous changes at the bite area and 2(2.12%) patients with acute renal failure were referred for haemodialysis to higher centre. Although bites from all the venomous snakes are known to cause acute renal failure, a substantial proportion of these cases results from viper bites. (19) There were no deaths among the snake bite patients admitted at our centre.

An association between the time of arrival at the hospital with the outcome of the patients was made using statistical software. Pearson Chi-Square test was performed to ascertain this relationship. It was found that patients admitted to the hospital after 6 hours of the bite had more chances of complications with some being eventually referred to higher centre. (p=0.009). [p value less than 0.05 is considered to be statistically significant].

CONCLUSION

At the end of our study we found that most of the cases of poisonous bites were neurotoxic in nature with ptosis being the predominant clinical feature. Most of the patients were more than 5 years of age with the mean age being 7.74 years. The incidence of snake bite was more in males as compared to females, more in the lower extremities as compared to upper extremities, more in the months of June to August

and more in rural areas as compared to urban areas. 42.55% of the cases were non-poisonous bites and 57.45% were poisonous snake bites. Out of the poisonous bites, 34.05% were neurotoxic snake bites and 23.40% were vasculotoxic snake bites. Most patients reported to the hospital within 6 hours of bite. Most of them hadn't used any first aid, while rest of them had used a tourniquet or application of herbs or had cut the affected part proximal to the bite before reaching the hospital. This might be due to poor awareness amongst the local people about the adverse outcomes that may arise out of these methods. Among neurotoxic snakebites, ptosis and ophthalmoplegia were the predominant symptoms and among vasculotoxic snakebites, cellulitis and oliguria were the predominant symptoms. Total 54 patients received ASV (anti snake venom) out of which 48 of them had received 30 vials of ASV. Out of 94 patients, 17 patients required invasive ventilation and 22 patients required non-invasive ventilatory support. Eventually 89 patients were discharged successfully and 3 patients were discharged with complications and 2 patients were referred to higher centre. No deaths were observed in our study. We also found that delayed arrival to the hospital was associated with a higher risk of complications. Incidence of complications is directly proportional to the duration of the venom in the blood prior to neutralization by ASV due to delayed arrival at the hospital. Research studies on ASV must be continued considering the different varieties of snakes all around the world. Awareness must be created among the general population about the type of first aid that can be used and the need to timely bring the patient to medical attention. This can help in reducing the mortality and morbidity arising out of snake bites in the world.

Author's Contribution

Chatterjee S.S Conceptualized the study, collected the data, conducted the study and drafted the manuscript.

Dikshit S. Compiled the data and performed the statistical analysis.

Barman M. Actively helped at every step of the study and contributed some intellectual contents.

Pal A. C. Supervised the study, revised the manuscript and finally prepared the manuscript and added many intellectual contents to the same.

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Declaration Of Consent– Proper informed consent was taken from the legal guardians of all patients regarding the publication of this information

Conflicts Of Interest – NONE

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