

## Original Research Article

# Epidemiological and clinical profile of paediatric snake bite patients at a tertiary care centre of Himachal Pradesh, India

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## ABSTRACT

**Background:** Pediatric snake bite cases are frequently encountered at health care centers of Himachal Pradesh. It is a medical emergency which require early hospitalisation and immediate medical intervention. This study determines the epidemiological and envenomation details along with clinical profile and management of pediatric snake bite patients in Himachal Pradesh, India.

**Methods:** This prospective clinico-epidemiologic study included 30 paediatric snake bite cases reported at Department of Paediatrics, IGMC, Shimla. Demography, envenomation details, first aid and treatment, antivenom administration and outcome were recorded for all patients.

**Results:** Of the total 30 cases, 56.6% were males and 43.3% were females. All patients were resident of rural areas and most of them belonged to middle socioeconomic status. Most (56.7%) snake bites occurred between 6pm to 12am and peak time was during rainy season. More cases of hemotoxic envenomation were observed as compared to neuroparalytic envenomation. Most common hematologic abnormalities were hematuria (4.8%) and epistaxis (4.8%). Respiratory paralysis, ptosis and ophthalmoplegia were the most common presentation in patients with neuroparalytic envenomation. Clinical profile of patients showed thrombocytopenia (26.7%), prolonged PT/INR (76.6%) and 36.7% had prolonged activated partial thromboplastin time. All symptomatic patients were given ASV as primary treatment out of which 79.2% patients required more than 10 vials of ASV. Most common complication observed in neuroparalytic envenomation was respiratory failure (33.3%) and in hemotoxic envenomation was coagulation failure (66.7%). Only 3.3% case fatality was observed in this study.

**Conclusions:** Snake bite in children is a medical emergency in hilly state of Himachal Pradesh where people still follow traditional first aid methods and treatment protocol. A widespread awareness programme is needed to propagate the newly advised first aid methods to prevent mortality by early hospitalization and administration of ASV.

**Keywords:** Snakebite, Envenomation, First aid, Hemotoxic, Neuroparalytic, Anti-snake venom

## INTRODUCTION

India has been known as “Land Of Snake Charmers” over centuries. It is estimated to have the highest snakebite mortality in the world.<sup>1</sup> The estimated total deaths in India are approx. 50,000/yr.<sup>2</sup> Pediatric snakebite mortality and morbidity contribute significantly to the national statistic.<sup>3</sup> It accounts for 3% of all deaths in children of age 5-14 years. The risk of snake bite in

children is high due to their curious nature and tendency to spend more time outdoors. In 2009, snake bite was recognized as neglected tropical disease by World Health Organization.<sup>4</sup> Himachal Pradesh is a small mountainous state situated in the north western Himalayas between 30°22'- 33°12'N and 75°47'-79°04'E covering an area of only 55,673 square km.<sup>5</sup> Geographically it has mountainous terrain with an altitudinal range of 350-6975 m. Due to extreme variation in elevation, a great

difference occurs in the climatic conditions as well as in presence of flora and fauna of Himachal. In addition to the common snakes found throughout India named “Big 4”- the Indian cobra (*Naja naja*), the common krait (*Bungarus caeruleus*), the Russell’s viper (*Daboia russelii*) and the saw-scaled viper (*Echis carinatus*), green pit vipers are commonly found in the hilly regions of India.<sup>6</sup> Few studies conducted to study Himalayan reptiles have documented presence of many venomous snakes like *T. albolabris* (white lipped pit viper), *G. himalayanus* (Himalayan pit viper) and *N. aoxiana* (black cobra) in addition to the common “Big 4”.<sup>7</sup> The data on the epidemiology of snakebites is sparse in India.<sup>3</sup> Though, it is an important public health issue epidemiological data especially in pediatric patients is insufficient. Due to paucity of epidemiological, demographical, clinical, morbidity and mortality data pertaining to paediatric snake bite in this region, this study was planned so that strategies related to the snake bite at individual, community and government level can be framed and executed.

## METHODS

This hospital-based prospective cohort study was conducted at department of Paediatrics IGMC, Shimla. All children up to 18 years of age with reliable history of snake bite as confirmed by themselves or by a reliable witness were included between June 2018 and

September 2019. Patients with known history of thrombocytopenia or bleeding disorders, neurological disorder, non-consenting patients, patients with non-reliable history or absconding patients were excluded. Demographic characteristics, history and details of envenomation, referral history and treatment, if any were recorded in a pre-designed proforma. All snake bite patients were investigated with 20 minute whole blood clotting time, complete blood count, coagulation tests, electrolytes and urine for hematuria for determination of type of envenomation. Treatment regime including administration of ASV was noted along with significantly altered laboratory values. Each patient was assessed thoroughly for dissipation of signs of envenomation. Outcome and prognosis was recorded. Data was expressed in its frequency and percentage. To elucidate the comparisons between different parameters (inferential statistics), Chi square ( $\chi^2$ ) test was used as nonparametric test. Students ‘t’ test was used to compare all parametric data. For all statistical evaluations, a two-tailed probability of value, <0.05 was considered significant.

## RESULTS

Among the 30 analyzed cases of paediatric snake bite, mean age observed was 12.23years±3.31(SD). Also, males were found to be more affected than females. The socioeconomic and age wise distribution of patients is shown in Table 1.

**Table 1: Socioeconomic and age wise distribution of snake bite patients.**

Age group (years)	Male	Female	Mean	Total	%
0-6	-	2	6	2	6.7
7-12	9	4	10.15	13	43.3
13-18	8	7	14.86	15	50
Socioeconomic status	Higher middle	-	-	-	-
	Lower Middle	17	12	14.5	29
	Low	-	1	1	1
Residency	Urban	-	-	-	-
	Rural	17	13	15	30

All bites were generally non-provocative. Majority of the bites occurred between 6 pm to 12 am at night (56.66 %) followed by 30% between 12pm - 6pm and 13.34% between 12 am-6 am. No bite case was recorded in morning hours between 6am to 12pm.

Table 2 shows diurnal variation in the timing of snake bite with majority of the accidents happening in the evening, though this data was found to be non-significant.

Lower extremities were observed to be the most bitten part of the body (70%) and the common sites were foot/fingers of foot/ankle/sole of feet as shown in Table 3.

All the cases recorded were presented in the months of May to November. Maximum number of cases of snake bite occurred during the months of August (30%) and September. Not a single case was recorded from December to March as shown in Table 4.

**Table 2: Time of snake bite.**

Time of bite	Male	Female	Total
6 am-12 noon	-	-	-
12 noon -6pm	5	4	9
6 pm to 12 midnight	10	7	17
12 midnight -6 am	2	2	4

Most of the patients 73.33% (n=22) admitted at IGMC, Shimla were referral cases, presented with either bite history or some features of envenomation. 70% of the bites were hemotoxic, 20% were dry bites and 10% were neuroparalytic bites. Some patients also had marked local reaction at the site of bite, hence the bites were further categorized as mentioned in Table 5.

**Table 3: Site of snake bite.**

Site of bite	Male	Female	Total
Leg/foot/fingers	11	10	21
Arm/hand/fingers	6	3	9
Head /shoulder	-	-	-
Other	17	13	30

**Table 4: Month wise distribution of snake bite patients.**

Months	Male	Female	Total	%
January	-	-	-	-
February	-	-	-	-
March	-	-	-	-
April	-	-	-	-
May	-	2	2	6.67
June	5	1	6	20
July	2	1	3	10
August	7	2	9	30
September	3	6	9	30
October	-	1	1	3.33
November	-	-	-	-
December	-	-	-	-

In hemotoxic envenomation, hematological manifestations like hematuria (4.8%) and epistaxis

(4.8%) were also observed in one-one patient. Proteinuria was observed in 19.04% (4/21) patients.

Acute kidney injury was observed in one patient which required hemodialysis. One patient with hemotoxic envenomation also required blood transfusion while Fresh frozen plasma (FFP) was given in (20.8%) five cases. One patient with respiratory distress required oxygen by nasal prongs only.

**Table 5: Type of envenomation.**

Type of envenomation	Male	Female	Total	%
No envenomation	2	4	6	20
Hemotoxic	4	1	5	16.7
Neurotoxic	1	1	2	6.6
Hemotoxic and Local	10	6	16	53.4
Neurotoxic and Local	-	1	1	3.3

Among the 3 cases of neuroparalytic envenomation, neurological manifestations like ptosis and speech difficulty was observed in all three patients while ophthalmoplegia and abdominal pain was observed in one-one patient. Proteinuria was also observed in one patient. Respiratory paralysis was the most common presentation with neuroparalytic envenomation. Hence, all the 3 patients required mechanical ventilation. Detailed clinical presentation is depicted in Table 6.

All the venomous snake bite patients received polyvalent ASV. Mean dose used was 250.83±117.47 ml (range: 100-600 ml) as depicted in Figure 1.

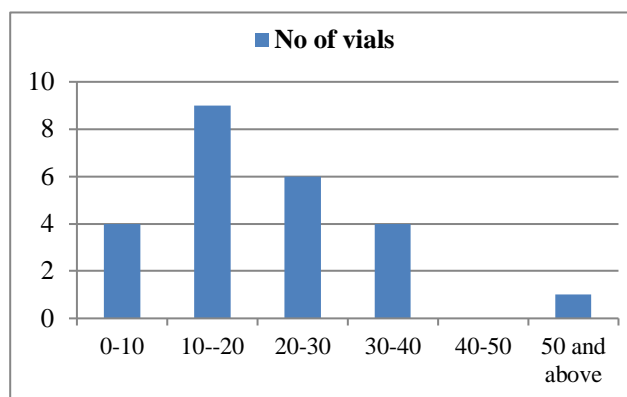
**Table 6: Clinical manifestation of patients (total=30).**

Envenomation	Clinical features	Hemotoxic	Neuroparalytic
Local signs	Pain	17	2
	Edema/swelling	17	1
	Cellulitis/Ulcer formation	1	-
	Burning sensation	11	-
	Redness	1	-
	Gangrene	1	-
Systemic signs	Vomiting	7	2
	Ptosis	-	3
	Abdominal pain	-	1
	Hypotension/shock	-	3
	Hematuria	1	-
	Speech difficulty	-	3

All patients received tetanus toxoid who had not received it at previous institutions. Neurotoxic snake bite patients

were also given anti-histaminics, steroids, antibiotics and ASV according to standards doses. After neostigmine

test, all three cases received Inj. Neostigmine and Atropine. Most common complication observed in neuroparalytic envenomation was respiratory failure (66.7%), followed by aspiration pneumonia (33.3%) as depicted in Table 7.



**Figure 1: Number of ASV vials used in patients.**

**Table 7: Complication after envenomation.**

Complications	No. of patients
Respiratory Failure	1
Bite site Gangrene	1
Aspiration pneumonia	1
Coagulopathy	10
Acute renal failure	1
Nasal Bleeding	1

In hemotoxic envenomation, coagulation failure was commonest complication (47.6%) followed by acute renal failure (4.8%), nasal bleeding (4.8%) and gangrene (4.8%). Among 30 cases, 28 cases had favorable outcome and patients were discharged with full recovery. One case with hemotoxic envenomation was referred to higher institution (PGI, Chandigarh), which was later discharged with full recovery. Total hospital stay of patients was 5.53±2.58 days with the longest duration of 13 days. One case fatality with neurotoxic envenomation was observed in the study.

## DISCUSSION

Snake bite attributes significantly to pediatric morbidity and mortality in hilly rural areas because of tough terrain, preference to traditional therapy rather than scientific medical approach and limited knowledge of first aid to be given in case of snake bite. Hence this study was conducted to know the demography, envenomation details, first aid and treatment protocol followed in paediatric snake bite cases. In this study, incidence of snake bite was more in boys among the age group of 13-18 years. This was found in concordance with other studies where the incidence was always higher in male children.<sup>8-10</sup> Which can be attributed to their more curious nature and outdoor activities. In this study most of the patients (100%) were resident of rural areas and most of

them (96.7%) belonged to lower middle socioeconomic status. It was observed that most (56.7%) of the snake bites occurred between 6pm to 12am and most of them were non provocative. It may be due to the fact that snakes are nocturnally active and due to low visibility snakes could be accidentally stepped upon. Lower extremities were mostly bitten (70%) either due to accidental stepping on snake while walking or playing in the dark and the common sites were foot, ankle, toe or sole of feet. This result was in agreement with various studies conducted throughout the world.<sup>8,11,12</sup> Most of the snake bites in this study were between May to November and peak time was during month of August to September. This fact coincides with the monsoon season in the state, when snake habitat is flooded with water, thus making them wander in search of safe and dry place. Also presence of rodents attracts them to human habitation. Hence, maximum vigil is needed during this season while working in agricultural fields, or pastures. Similar types of observations were reported in previous studies.<sup>13,14</sup> Five patients were presented at hospital with tourniquet application as first aid by parents/guardian, in one patient multiple cuts were attempted to remove the venom from bitten part and in one patient attempt was made to suck out venom and then apply tourniquet. According to Amaral et al, and National snake bite guideline and protocol tourniquet should not be applied.<sup>11,15</sup> Also, cuts or incisions on or near the bitten area should not be made. Hence people should be made aware not to practice such methods but to just immobilize the bitten part and transport the victim immediately to hospital. The first aid being currently recommended is based around the mnemonic. “CARRY NO R.I.G.H.T” It consists of the following: CARRY = Do not allow victim to walk even for a short distance; just carry him in any form, especially when bite is at leg; NO = Tourniquet, Electrotherapy, Cutting, Pressure immobilization, Nitric oxide or Nitrogenic ointment/ Nitrate Spray; R= Reassure the patient; I = Immobilize in the same way as a fractured limb; GH= Get to Hospital Immediately. Hence, it may be propagated at mass levels.

In this study, most of the symptomatic patients were cases of hemotoxic envenomation (87.5%) as compared to neuroparalytic envenomation (12.5%). This was in concordance with study conducted by Gupt et al, in which hemotoxic envenomation was reported more than neurotoxic envenomation.<sup>16</sup> Another reason for reporting of fewer neurotoxic bites in this study could be due to the low prevalence of neurotoxic snakes in surrounding area of Shimla. Saikia et al, has studied the herpetofauna of Himachal Pradesh in details and reported abundant presence of *Trimeresurus albolabris* (White-lipped pit viper) and *Gloydius himalayanus* (Himalayan Pit Viper) from Solan, Shimla and Mandi districts of Himachal Pradesh.<sup>7</sup> But studies from other regions of Himachal Pradesh show a prevalence of neuroparalytic envenomation over hemotoxic envenomation.<sup>17,18</sup> Hence, further studies including large number of subjects are needed to explore this aspect. In this study, local

edema/swelling was the most common (80.9%) (n=17) clinical feature seen in all patients of hemotoxic snake bites while cellulitis/gangrene was seen in only one patient (4.8%). Hemotoxic snake bite caused hematuria (4.8%) and epistaxis (4.8%) in one-one patient while proteinuria was observed in 19.04% patients. Acute kidney injury was observed in one patient who required hemodialysis. Out of the 3 cases presented with neuroparalytic syndrome, only one case was presented with early morning neuroparalytic syndrome. All the 3 patients required mechanical ventilation. It may be advocated that all neuroparalytic envenomation patients must be transported to a mechanical ventilation facility at the earliest for better prognosis.

All patients admitted were evaluated using a wide range of biochemical tests depending upon the type of envenomation. All patients had normal hemoglobin level but most of them (70.83%) had leukocytosis with neutrophilia (82.4%) on admission. Presence of neutrophilic leucocytosis signifies systemic absorption of venom. This may be attributed to contamination of bite wounds with micro-organisms of snake's mouth. About 26.7% had thrombocytopenia with platelet count less than 1.5 lakhs, 76.7% had prolonged PT/INR and 36.7% had prolonged activated partial thromboplastin time. Thrombocytopenia may be a feature of viper envenomation. Prothrombin time (PT) and activated partial thromboplastin time (aPTT) prolongation may be present in viper bite. The actions of venom proteases, thrombin like enzymes, and phospholipases induce these changes.<sup>19</sup> In this study, thrombocytopenia was observed only in hemotoxic envenomation.

Polyvalent ASV (Antivenom) was given to all the 24 venomous bite patients as primary treatment. Mean dose used in this study was 250.83±117.47 ml (range: 100-600 ml). According to standard treatment guidelines for management of snake bite (2017), additional vials can be considered depending on the patient condition.<sup>20</sup> Therefore, more ASV vials were required for the reversal of normal clinical parameters. Adverse reactions in the form of early anaphylactic reactions to antivenom were seen in 10% patients, but there were no deaths. In such cases, ASV was stopped and an injection of adrenaline 1:1000 was given @ 0.01 mg/kg body weight, IM along with histamine-blockers and steroids. Most common complication observed in neuroparalytic envenomation was respiratory failure (66.7%) followed by aspiration pneumonia (33.3%). In hemotoxic envenomation, coagulation failure was the commonest complication (47.6%) followed by acute renal failure (4.8%), nasal bleeding (4.8%) and gangrene (4.8%). Among 30 cases, 28 cases had favorable outcome and patients were discharged with full recovery. One case fatality with neurotoxic envenomation was observed due to MODS and cardiopulmonary arrest in the study. Mean hospital stay of the patients was 5.53±2.58 days with longest duration of 13 days.

## CONCLUSION

Snake bite in children is a medical emergency that occur frequently in Himachal Pradesh. Due to abundant forest cover and favorable climate a wide variety of venomous snakes are distributed throughout the state. Most people including children residing in rural areas still follow traditional ways of living by rearing animals and collecting firewood from forests, hence they are at a great risk for snake bite envenomation. Since adolescent young children are mostly affected and most cases occur during rainy season, mass awareness should done in this regard by organization of awareness camps or awareness lectures in schools to educate the young children about currently recommended first aid techniques in snake bite cases. Because much of the first aid currently carried out is ineffective and dangerous (i.e. cuts, sucking, tourniquet), and hence it must be discouraged. Since timely transport and early administration of ASV is crucial in saving the life of a snake bite patient, hence people must be made aware of this fact and first aid by locals/quacks must be discouraged.

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