Research Article

Snakebite profile from a medical college in rural setting in the hills of Himachal Pradesh, India

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Abstract

Objective: The objective of the following study is to assess the clinical profiles and manifestations of snakebite patients in the rural hilly setting of Shivalik and the Lesser Himalayan region of Himachal Pradesh. **Materials and Methods:** A hospital record-based retrospective descriptive study was carried out that included details on demography, clinical profile, treatment and outcome among 200 patients over a period of 2 years. The data was analyzed using Chi-square test for comparison. **Results:** 142 (71%) patients were young (age group of 16-45 years) and the number of male patients was 118 (59%) and female patients were 82 (41%). All the cases recorded presented in the months of April to November. Not a single case was recorded from December to March. The most frequently bitten sites were the lower limbs particularly the feet. 86 (43%) of the patients presented without any features of envenomation. Neuroparalysis was the commonest presentation in 53 (46%) patients followed by hemotoxicity in 36 (31%) among symptomatic patients. Early morning neuroparalysis syndrome was the presentation in 26.4% patients. Allergic reactions in the form of early anaphylaxis were noted in 7% patients. **Conclusion:** Snake bite is a neglected tropical disease affecting poor villagers in rural areas. Future research focusing on understanding epidemiological determinants of snake bite is desired.

Keywords: Envenomation, Himalayas, neglected tropical disease, reptiles

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Introduction

Snake bite is an established important cause of morbidity and mortality among the poor, rural tropical population.[1] Medical emergencies like snake bites in mountainous terrains are in itself a challenge.[2] Hilly terrain is a special environment, which provides natural setting to study the challenges in the management of snakebite cases. Eco-rich vegetation due to a long rainy season, abundant flora and fauna and a scattered population using paths traversing rural and forest lands makes people in these areas particularly prone to snake bite.[3] The reptilian fauna shows geographical variation in habitation of medically important venomous snake species. Existence of venomous snakes like *Trimeresurus albolabris* (white lipped pit viper), *Gloydius himalayanus* (himalayan pit viper) and *Naja oxiana* (black cobra) has been documented in the state of Himachal Pradesh, India in addition to the common "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*) which are found throughout India.[4] The spectrum of envenomation is broadly assumed to be the same throughout India, but the diversity of venomous species questions the effective use of polyvalent anti-snake venom (ASV) raised and imported from one state to another.[5] On-scene resource constraints, ignorance, use of local herbal treatment and other indigenous medicines and transportation difficulties in the hilly terrain prevent patients from reporting in time to centers where snake antivenom is available.[6,7] In 2009 snake bite was recognized as a neglected tropical disease by the World Health Organization.[8] Though snake bite is an important public health issue epidemiological data is insufficient. The purpose of this study is to describe the clinical profiles and manifestations of patients of snakebite admitted to our hospital located in Shivalik and

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the Lesser Himalayan region of Himachal Pradesh over the last 2 years. No studies on snake bite are available from this region to the best of our knowledge.

Materials and Methods

In a hospital record-based retrospective descriptive study, we evaluated snakebite cases admitted to the hospital under the Department of Medicine from July 2010 to June 2012. Data were collected from the Medical Records Department of the 570 bedded, tertiary care hospital which caters to the rural hilly population of the physiogeographic zone of Shivalik and Lesser Himalayas of the state of Himachal Pradesh, India. Recorded information was entered in a pre-coded proforma and included details on demography, clinical profile, treatment and outcome. We evaluated the records of all snakebite cases where complete information was available as per the pre-coded proforma parameters. Excluded were five snakebite patients who absconded or were discharged against medical advice and where records were incomplete. The data collected was cross-checked by two independent observers. The data was analyzed using Chi-square test for comparison. Cochran-Armitage test for trend was used to analyze trends.

Results

A total of 200 cases of snake bite were analyzed. Most of the patients were young with the mean age of 36.52 ± standard deviation (SD) 13.43 (range: 13-74 years) and the number of male patients was higher than female patients. The decade wise distribution of patients is shown in Table 1. All the cases recorded presented in the months of April to November. Maximum of 50 (25%) patients were recorded in the month of August. Not a single case was recorded from December to March as shown in Table 2. On analysis for trends the difference however was not statistically significant. Table 3 shows diurnal variation in the timing of snake bite with majority of the accidents happening in the evening, though this difference was not statistically significant. Analysis of time taken between bite and presentation to hospital is represented in Table 4. The most frequently bitten site was lower limbs and foot happened to be the most common site as shown in Table 5. Most of the patients presented without any features of envenomation. Neuroparalysis was the most common presentation and was seen in 46% (53/114) patients among symptomatic patients. Detailed clinical presentation is as depicted in Table 6. Among patients with neuroparalysis early morning syndrome occurred in 26.4% (14/53) patients. Out of 53 patients with neuroparalytic features, 20 patients required mechanical ventilation. Acute kidney injury was observed in 22 (11%) patients and they belonged to the hemotoxic or the hemotoxic with local symptoms and signs group. One patient developed a compartment syndrome of calf region. Mean of total admission days was 2.52 ± SD 1.688. All the 114 symptomatic patients had received polyvalent ASV. Dose used was 292.69 ± 196.27 ml (range: 50-950 ml). Allergic reactions in the form of early anaphylaxis were noted in 7% (8/114) patients. Interestingly 4 (2%) patients had features of alcohol intoxication simultaneously at presentation. 10 (5%) patients died. Deaths were due to ventilator-associated pneumonia in 4, refractory shock in 2, massive gastrointestinal bleed in 2 and cardiorespiratory arrest in 2.

Discussion

The state of Himachal Pradesh in the northwestern Himalayas extends between 32°22′-33°12′N and 75°45′-79°04′E covering an area of 56,090 km^2. Topography of the state is dominantly mountainous with the altitudinal range of 350-6975 m. The state has an estimated forest cover of 13,880 km^2 which is 25% of the total geographic area of the state.[4] The state has a total population of 68,56,509 and 90.2% people live in rural setup.[9] The state has an ideal environment for the different species of reptiles.[4] Probability of human beings coming in contact with snakes is very high. Reptilean fauna in this region is somewhat different from that of other parts of India. Venomous snakes inhabit the foothills and mountainous ranges. Attempts to record reptilian fauna of Himachal Pradesh has revealed presence of venomous snakes like *T. albolabris* (white

Table 1: Age wise distribution of snake bite patients (*n*=200)

Age group (years)	*n* (%)			Mean age (standard deviation)		
	Male	Female	Total	Male	Female	Total
Below 15	3 (1.5)	5 (2.5)	8 (4.0)	14.43 (0.98)	13.86 (1.04)	14.08 (0.99)
16-30	38 (19)	30 (15.0)	68 (34.0)	24.00 (4.15)	24.87 (2.94)	24.38 (3.67)
31-45	43 (21.5)	31 (15.5)	74 (37.0)	38.20 (3.41)	36.41 (4.01)	37.45 (37.0)
46-60	28 (14.0)	12 (6.0)	40 (20.0)	52.29 (3.47)	52.67 (3.89)	52.40 (3.55)
Above 60	6 (3.0)	4 (2.0)	10 (5.0)	68.67 (5.46)	63.50 (1.73)	66.60 (4.97)
Total	118 (59.0)	82 (41.0)	200 (100)	37.92 (13.73)	34.51 (12.78)	36.52 (13.43)

n: Number

Table 2: Month wise distribution of snake bite patients (*n*=200)

Month	Male	Female	Total
January	-	-	-
February	-	-	-
March	-	-	-
April	6	-	6
May	12	14	26
June	22	10	32
July	23	11	34
August	21	29	50
September	14	10	24
October	18	4	22
November	2	4	6
December	-	-	-

Table 3: Time distribution of snake bite patients

Time of snake bite	Male	Female	Total	Odds ratio
6 am-12 noon	25	15	40	0.26
12 noon-6 pm	30	18	48	0.33
6 pm-12 midnight	38	28	66	0.53
12 midnight-6 am	18	14	32	0.20

Table 4: Time taken between bite and presentation

Time of presentation	Male	Female	Total (%)
Within 1 h	16	11	27 (13.5)
1-6 h	76	52	128 (64)
6-12 h	14	9	23 (11.5)
More than 12 h	12	10	22 (11)

Table 5: Site distribution of snake bite patients

Site	Male	Female	Total	Odds ratio
Foot	48	20	68	0.51
Hand	25	20	45	0.28
Ankle	12	14	26	0.14
Leg	10	6	16	0.08
Arm	6	5	11	0.05
Head	4	6	10	0.05
Shoulder	2	-	-	-
Wrist	-	1	-	-
Ear lobe	1	-	-	-
Not known	10	10	20	0.11

Table 6: Clinical presentation of patients

Type of presentation	Male	Female	Total (%)
No envenomation	50	36	86 (43)
Neuroparalytic	32	21	53 (26.5)
Hemotoxic	21	15	36 (18)
Local only	15	10	25 (12.5)
Neurotoxic and local	2	2	4 (2)
Hemotoxic and local	12	9	21 (10.5)

lipped pit viper), *G. himalayanus* (Himalayan pit viper) and *N. aoxiana* (black cobra) in addition to the common "Big 4" - the Indian cobra (*N. naja*), the common krait (*B. caeruleus*), the Russell's viper (*D. russelii*) and the saw-scaled viper (*E. carinatus*). It is important that snakes belonging to Viperidae group have been abundantly found up to an altitude of 4850 m.[4] Antivenom is the only specific treatment for snake bite envenoming, but existing products cover only the "Big 4" i.e., limited number of medically significant species. This diversity of venomous species questions the effective coverage of Indian polyvalent ASV. Deaths due to snake bite occur predominantly in rural areas (97%) and majority of them happen outside areas with access to health care facilities.[5] In an analysis of snake bites in India, the death rate in the state of Himachal Pradesh was not known.[10] In the present study, patients of snake bite are mostly young and predominantly males. The predominance of young male victims suggests that more ambulant population is at the highest risk for snake bite in this region and has been reported in studies from different places in India.[11-13] Female preponderance has been observed in a study done in another physiographic zone of lower Shivalik Himalayan region of the state. Women in hills are involved in cutting grass for fodder more frequently.[3]

All the cases of snake bite occurred in the months of April to November, which corresponds with summer, monsoon and the harvesting season in this region, all ideal for snakebites. None of the cases was reported from the month of December to March. The maximum bites occurred during the month of August, in the rainy season, when vegetation is abundant and people are involved in intense agricultural activities. This distinct seasonal pattern with peaks in the warm and rainy months has been observed in the state of Himachal Pradesh, as in other parts of the country.[3,10-15] This observation is important from the prevention aspect as this is the time when maximum vigil is required to guard against the snake bites. No definite pattern for the time of bite was observed in our cases as is evident from wide variability. The time of bite corresponds to the outdoor activities and relative abundance of diurnal and nocturnal snakes. It was observed that only a few (13.5%) of the patients attended hospital within the 1st h of bite and the majority (64%) attended between 1st and 6 h. 22 (11%) patients arrived at this hospital after 12 h of bite. Most of these patients were either referred from neighboring health centers or arrived late at the appearance of symptoms or complications in the form of acute renal failure. Difficult topography, delayed transportation in addition to lack of awareness of the hazards of snakebite and initial preference for alternative systems of medicine are the main reasons for delay in arrival as reported in the past.[14] The bite-to-treatment delay varies greatly in studies from different health care centers of India.[16-19]

Lower limbs were the commonest site of bite in 55% (110/200) patients and foot was involved in 61% (68/110) cases. It was followed-up by upper limbs out of which hand and fingers accounted for 22.5% (45/200). More exposed sites of the body were the commonly bitten sites as reported elsewhere.[14,15,20] Bites on the uncommon sites like head and trunk are mostly due to nocturnal species biting people who are asleep.

Majority of the snakebite cases in the hills of Himachal Pradesh are due to either non-venomous snakes or "dry bites" of venomous snakes. Among the symptomatic patients common were neuroparalytic followed by hemotoxicity. Local signs only in the form of ecchymosis, swelling and necrosis were observed in 21.9% (25/114) patients. Out of 36 patients with hemotoxicity, local symptoms and signs were found in 21 patients (typical syndrome of Viperidae species bite) and four patients with neurotoxicity had additional local features. The reasons for local signs in these patients are difficult to attribute to a single cause as 116 patients had applied tourniquets and indigenous herbal medicines. *T. albolabris* (white lipped pit viper), *G. himalayanus* (himalayan pit viper) bites are known for predominant local signs in the form of pain, marked swelling, bruising and bleeding. Fortunately none of the patients had resorted to the incision and drainage of the bite site in this region, a practice currently not recommended. Out of the cases presenting with neuroparalytic syndrome 26.4% presented with early morning symptoms. These rare syndromes occur by krait bites. The kraits often enter the houses in search of food especially during midnight to early morning. The person sleeping on the floor/open environment is particularly susceptible to their bite. A false reassurance is created by paucity or absence of local pain and swelling after krait bite. This may delay the treatment of envenomation. The absence of bite mark with no specific history of snake bite makes diagnosis and management complex.[21,22]

At our center, out of a total of the 200 patients admitted with history of snake bite 22 (11%) patients developed acute kidney injury. In India, the incidence of acute renal failure is 13-32% following viper bite.[23]

Antivenom was given to all the 114 symptomatic patients. Although the dose of antivenom is not yet fixed, the indications are well-known. National snake bite management protocol 2008 (India) has recommended a maximum dose for hemotoxic and neurotoxic bites as 30 vials (300 ml) and 20 vials (200 ml) respectively. We need to look into the reasons for higher dose required in our cases. One of the observations was higher dose used to reverse the effects of persistent coagulopathy in our patients. We have to move toward symptom analysis and treatment relevant to a specific snake species is the ideal but not always possible.[5] Adverse reactions in the form of early anaphylactic reactions to antivenom were seen in 7% patients, but there were no deaths. Antivenom reactions are known in more than 10% who receive antivenom.[24] The death rate in our study was 5% and compares well with the death rate from other studies across India.[20]

Limitations

A retrospective analysis was one of the limitations of this study, since some of the important data were incomplete or insufficient and they may not reflect the exact statistics. In spite of the limitations, the data can be generalized to some extent as the study center happens to cater to two thirds of the state population. Further with strong public health infrastructure utilization and absence of organized private sector in the state lends credibility to this generalization.

Conclusion

Snake bite is a neglected tropical disease affecting poor villagers in rural areas. The data and research from this region is primitive on the clinically important subject of bites due to reptilian fauna and their manifestations. Further studies on venom biochemistry and pharmacology are warranted. Future research focusing on understanding epidemiological determinants of snake bite is essential.

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