Original Article

Snakebite profile from a tertiary care setup in a largely rural setting in the hills of North-West India

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Abstract

Background: Snakebite, a medical emergency, faced by rural populations in tropical and subtropical countries assumes special significance in hilly terrains. Therefore, the hills provide a natural setting to study the challenges in the management of snakebite cases. **Methodology:** A hospital record-based retrospective descriptive study was conducted. Data were collected from the Medical Records Department of the 821-bedded, tertiary care hospital catering to the rural hilly population of the state of Himachal Pradesh, India. Information were recorded on details of demography, clinical profile treatment and outcome. **Results:** A total of 252 patients were analyzed. Maximum patients were in the age-group of 21–40 (43.7%) with mean and standard deviation of 30.52 ± 5.693 and 31.81 ± 7.117 for male and female, respectively. A small minority (17.06%) of patients reported to health facility within 4–6 h of the bite. Maximum bites were on lower limb (143;56.74). Overall mortality rate in our study was 2.38%. **Conclusion:** Large-scale studies on epidemiological determinants of snakebite coupled with research in venom biochemistry and bio-pharmacology of anti-snake venom (ASV) are needed. The study also provides insights into the role of primary care practitioners in creating an ecosystem favorable for snakebite management at local level.

Keywords: Envenomation, outcome, profile, snakebite

Introduction

India accounts for almost half of the total number of annual snakebite deaths in the world.[1] As per a report, India reported 1.2 million snakebite deaths (representing an average of 58,000 per year) from 2000 to 2019. Nearly half of these deaths were in the age-group of 30–69 years with over a quarter being children under 15 years of age.[1]

As per available reports, there are about 216 species of snakes in India, of which only four are being reported as venomous (cobra, krait, Russell's viper, and saw-scaled viper).[2] Himachal Pradesh, a northern India state, situated in the Western Himalayas is one of the 11-mountain states in the country.

The state has reported the existence of venomous snakes like *Trimeresurus albolabris* (white lipped pit viper), *Gloydius himalayanus* (Himalayan pit viper) and *Naja oxiana* (black cobra) 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.[3]

An important aspect of morbidity due to snakebite is its large-scale neglect by public health. Despite being a common acute medical emergency, snakebite has been largely ignored by public health in India with very few large-scale epidemiological studies having been conducted. Mountainous terrains are a special challenge as the terrain in itself increases the challenge medical emergencies

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Table 1: Age-wise distribution of snakebite cases (*n*=252)

Age-group (years)	*n* (%)			Mean age±Standard deviation		
	Male	Female	Total	Male	Female	Total
>20	6 (2.4)	14 (5.6)	20 (8.0)	19.33±0.816	17.71±3.148	18.20±2.745
21-40	52 (20.6)	58 (23.0)	110 (43.7)	30.52±5.693	31.81±7.117	31.20±6.486
41-60	27 (10.7)	66 (26.2)	93 (36.9)	48.22±5.733	49.24±5.375	48.95±5.470
>60	14 (5.6)	15 (6.0)	29 (11.6)	69.29±7.087	68.00±4.971	68.62±6.008
Total	99 (39.3)	153 (60.7)	252 (100.0)	40.15±15.72	41.59±14.75	41.02±15.129

like snakebites bring on.[4] The Hills are a special environment, thereby providing special setting to study the challenges in the management of snakebites. The geography offers eco-rich vegetation and abundance of flora and fauna. A scattered population using paths traversing rural and forest lands makes people in these areas particularly vulnerable to snakebite.[5]

Material and Methods

A hospital record-based retrospective descriptive study was conducted. Data were collected from the Medical Records Department of the 821-bedded, tertiary care hospital catering to the rural hilly population of the state of the physio-geographic zone of Shivalik and Lesser Himalayas of the Himachal Pradesh state of India. Data on all snakebite cases admitted to the tertiary care hospital from January 2018 to December 2018 was retrieved using a structured format after obtaining institutional permission for the same. The data were entered in a pre-coded proforma and included details on demography, clinical profile, treatment, and outcome. Only records of snakebite cases in which complete information was available were included in pre-coded proforma parameters. Snakebite patients who absconded or were discharged against medical advice and where records were incomplete were excluded.

Statistical analysis

Quantitative data analysis will include means, standard deviation, and proportions. The data were analyzed using Chi-square test for comparison. Risk was estimated using odds ratio. Data analysis was done by epi.info app version 7.

Results

A total of 252 patients were analyzed. Majority (153/252; 60.7%) of the patients was female and the maximum number of patients (110/252; 43.7%) was in the age-group of 21–40 with mean and standard deviation of 30.52 ± 5.693 and 31.81 ± 7.117 for male and female, respectively [Table 1]. Time distribution of snakebite is shown in Table 2 with maximum bites being seen between 12 noon to 6 pm. However, the difference in the proportion of patients reporting in different time slots was not statistically significant. Only 3.12% (8/252) patients reported to health facility within 1 h of the bite with [Table 3]. A substantial number (161/252; 63.58%) had no information on their first contact with healthcare facility. Majority of bites (143/252; 56.74%) were on the lower limb with an odds ratio of 1.957 and CI of 1.376–2.81 [Table 4].

Table 2: Time distribution of snakebite cases (*n*=252)

Time of snakebite	Male	Female	Total	Odds ratio
12 midnight - 6 AM	17	20	37	1.37
6 AM-12 noon	18	33	51	0.80
12 noon-6 PM	30	59	89	0.69
6 PM-12 midnight	34	41	75	1.42
Total	99	153	252	

Table 3: Time between bite and first health contact (*n*=252)

Time of presentation	Male	Female	Total (%)	Statistics
Within 1 h	05 (1.98)	03 (1.19)	08 (3.12)	Chi-square=3.868, df=4, *P*=0.4242, Not significant
2-4 h	01 (0.39)	05 (1.98)	06 (2.38)	
4-6 h	15 (5.95)	28 (4.39)	43 (17.06)	
>6 h	12 (4.76)	22 (11.11)	34 (13.49)	
No information	66 (26.19)	95 (37.69)	161 (63.58)	
Total	99 (39.27)	153 (60.72)	252 (100.0)	

The clinical presentation of data reveals that no signs of envenomation in 59.52% (150/252) of patients. Out of the envenomation found 26.58% (67/252) of bite was reported as hematotoxic while 11.90% (30/252) were reported as neurotoxic [Table 5]. A small percentage (5/252; 1.98%) showed a mixed pattern. The data analysis revealed that all snakebite patients recorded presence from April onwards till October [Table 6], with June to September being the peak season of presentation (221/252; 87.6%). Maximum bites were reported in July (74/252; 29.3%) followed by August (63/252; 25%). Majority (94/252; 37.3%) of patients did not report a particular activity at the time of the bite [Table 7]. However, a significant number of patients (74/252; 29.4%) mentioned farming as their activity during the bite. Importantly 13.09% (33/252) of patients reported of bite while sleeping.

A significant majority (176/252; 69.84%) of patients did not report of application of tourniquet at the time of bite [Table 8]. A large majority (222/252; 88.1%) refused to have taken any alternate medicine for the management of the snakebite. Acute kidney injury was present in 6.74% (17/252) of patients, whereas cranial bleed was present only in 0.4% of the patients [Table 9]. A significant minority of patients (6/252; 2.3%) did not survive the snakebite [Table 10].

Discussion

The data analysis although restricted to a tertiary care setup provides insight into morbidity due to snakebite in a largely rural

Table 4: Site distribution of snakebite cases (*n*=252)

Site	Male	Female	Total	Odds ratio	CI 95%
Upper limb	42 (16.66)	61 (24.20)	103 (40.87)	1.07	0.7449, 1.539
Lower limb	53 (21.03)	90 (35.71)	143 (56.74)	1.957	1.376, 2.81
Any other part	04 (1.58)	02 (0.79)	06 (2.38)	0.02105	0.003484, 0.07118
Total	99 (39.27)	153 (60.72)	252 (100.0)		

Table 5: Clinical presentation of the cases (*n*=252)

Type of presentation	Male	Female	Total (%)	Statistics
Neurotoxic	17 (6.74)	13 (5.15)	30 (11.90)	Chi-square=4.595, df=3, *P*=0.2040, Not significant
Hemotoxic	23 (9.12)	44 (17.46	67 (26.58)	
Mixed	02 (0.79)	03 (1.19)	05 (1.98)	
No envenomation	57 (22.61)	93 (936.90)	150 (59.52)	

Table 6: Month-wise distribution of snakebite cases (*n*=252)

Month	Male	Female	Total
Jan.	0	0	0
Feb.	0	0	0
Mar.	0	0	0
Apr.	0	04	04
May.	02	07	09
Jun.	14	26	40
Jul.	33	41	74
Aug.	22	41	63
Sep.	21	23	43
Oct.	06	12	18
Nov.	0	0	0
Dec.	0	0	0
Total	98	154	252

Table 7: Activities of snakebite cases during bite (*n*=252)

Activity	Male	Female	Total	*P*
Farming	21 (8.33)	53 (21.03)	74 (29.36)	Chi-square=11.02, df=6, *P*=0.087, Not Significant
Walking	15 (5.95)	18 (7.14)	33 (13.09)	
Sleeping	18 (7.14)	15 (5.95)	33 (13.09)	
Bathing	01 (0.39)	07 (2.77)	08 (3.17)	
Sitting	02 (0.79)	01 (0.39)	03 (1.19)	
Toileting	03 (1.19)	04 (1.58)	07 (2.77)	
Unknown	39 (15.47)	55 (21.82)	94 (37.30)	
Total	99 (39.27)	153 (60.72)	252 (100.0)	

population in addition to some insights into the potential role of healthcare providers in primary care settings in dealing with such situations. As per the data analysis, the maximum number of patients in our study belonged to the age-group of 21–40 years. This age-group being highly active and involved in outdoor activities is increasingly more prone to snakebite. Studies on similar domain report similar results.[6,7] An increased proportion of patients belonging to the female gender could be attributed to the vocation of the females in this physio-geographic zone.

Grass cutting activity for fodder is a common practice resorted to by the females in this region.[8,9] This could be the reason that our proportions are not similar to some other studies where male (74.2%) were more in number than females the reason.[10] Maximum bites were between 12 noon to 6 pm, reflecting the time when people are mostly outdoors doing their chores.

Snakebite cases occurred, starting from the month of April till October which is ideal condition for snakes. Also, this season is ideal for harvesting and also marked by monsoons, adding on to the favorable conditions for snakebites.[8] 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.[5,8,9,11-15]

There were only eight patients who presented to the hospital (or health facility) within 1 h. Acute kidney injury was seen in 6.7% of patients, which could be attributed to late presentation to the hospital leading to the development of complications. Initial delay in transportation and inadequate ambulance services coupled with low level of awareness on the nature of intervention could be the reasons for delayed presentation to the health facility.[8,14] As per studies, the incidence of acute renal failure is around 13–32% following viper bite in India.

Majority of bites were in the lower limbs (150) followed by the upper limb (96) which are generally the exposed parts of the body. Similar findings have been reported by other studies.[8,14-16] A large proportion of patients presented with no signs of envenomation, which again emphasizes the need for creation of awareness among general public as well the healthcare providers in the primary care setting. Correct information would reduce panic and save vital time in instituting management. Furthermore, this would reduce unnecessary burden on emergency department.[10] Increased awareness will also ensure lesser and lesser use of tourniquet application and alternate medicine.

Overall mortality rate in our study was 2.38%, which was a little higher than as seen in another study.[11] The probable reason could be delayed presentation to the health facility, delayed administration of ASV. However, the mortality rate after snakebite depends upon various factors like type of snakebite, amount of venom injected, site of bite (serious if bitten on the trunk or head, neck, and face), species and size of the snakes, the extent of its anger or fear, the presence of bacteria in the mouth of the snake or on the skin of the victim.[11]

The study although restricted to one physio-geography does highlight the management difficulties posed by mountain terrain. It also raises issues regarding the lack of available and easily

Table 8: Tourniquet application and use of alternative medicine at the time of bite (*n*=252)

	Male	Female	Total	Statistics
Tourniquet Status				
Applied	32 (12.69)	44 (17.46)	76 (30.15)	Chi-square: 0.3627, *P*: 0.5470, df: 1, non-significant
Not applied	67 (26.58)	109 (43.25)	176 (69.84)	
Total	99 (39.28)	153 (60.71)	252 (100.0)	
Alternate medicine				
Taken	11 (4.36)	19 (7.53)	30 (11.90)	Chi-square: 1.791, *P*: 0.1811, df: 1; non-significant
Not taken	88 (34.92)	134 (53.17)	222 (88.09)	
Total	99 (39.28)	153 (60.71)	252 (100.0)	

Table 9: AKI/Cranial bleed among snakebite cases (*n*=252)

	Male	Female	Total	Statistics
AKI				
Present	10 (3.96)	07 (2.77)	17 (6.74)	Chi-square: 3.164, *P*: 0.07528; df: 1, Not significant
Absent	86 (34.12)	146 (57.93)	235 (93.25)	
Total	96 (38.09)	153 (60.71	252 (100.0)	
Cranial bleed				
Present	01 (0.39)	0 (0)	01 (0.39)	Chi-square: 1.552, *P*: 0.2133; df: 1, Not significant
Absent	98 (38.88)	153 (60.71)	251 (99.61)	
Total	99 (39.28)	153 (60.71)	252 (100.0)	

Table 10: Outcome of snakebite cases (*n*=252)

Age-Group (years)	Outcome						Total
	Survived		Referred		Died		
	Male	Female	Male	Female	Male	Female	
0-20	06 (2.38)	09 (3.57)	00 (0)	01 (0.39)	00 (0)	01 (0.39)	17 (6.74)
21-40	43 (17.06)	50 (19.84)	03 (1.19)	02 (0.79)	01 (0.39)	02 (0.79)	101 (40.07)
41-60	30 (11.90)	67 (26.58)	02 (0.79)	04 (1.58)	00 (0)	01 (0.39)	104 (41.26)
>60	12 (4.76)	15 (5.95)	01 (0.39)	01 (0.39)	01 (0.39)	00 (0)	30 (11.90)
Total	91 (36.11)	141 (55.95)	06 (2.38)	08 (3.17)	02 (0.79)	04 (1.58)	252 (100.0)

accessible snakebite management at all places. In addition to the fact that large-scale studies on epidemiological determinants of snakebite coupled with research in venom biochemistry and bio-pharmacology of anti-snake venom (ASV) are needed, research also needs to focus on the role of primary care physicians in the management of snakebite. An integration of snakebite management into injury management protocols as part of comprehensive emergency care with primary care physician as focus will go a long way in preventing mortality. Creating an ecosystem favorable for snakebite management at primary care level will be the key.

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Conflicts of interest

There are no conflicts of interest.

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