

Epidemiology of Snake Bites Based on Hospital Survey in Chitwan and Nawalparasi Districts, Nepal

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Abstract

Introduction	Snake bite is significant public health problem in many countries with large number of envenomings and death. The sparse studies have looked at the epidemiology of snake bite in Nepal.
Objective	Characterization and collation of the epidemiology of snake bite in Chitwan and Nawalparasi Districts
Methods	The retrospective descriptive study of snake bite victims in hospital record files was in progress from 15 Sept. 2004 to 15 Sept. 2005 at two hospitals. The analysis of the data was done on percentage basis.
Results	Of the total, the maximum snake bite victims in Bharatur Hospital, Chitwan reflect the availability of anti-snake venom serum (ASVS) vials in free of cost. When alleged in percentage basis, the largest numbers of snake bites were recorded from Nawalparasi. The maximum snake bites in 15 June to 15 July (Ashad) and in summer season reflect optimum environment to snakes and no snake bite victims in winter reflect their hibernation. Of the totality, 49% victims were males; the maximum (23%) were between 20–30 yrs.; 104 (12%) were venomous with 25% hospital case fatality rate. Of the total fatality, 27 percent deaths were recorded in the age group of 0-10 yrs. An average of 32 ASVS serum vials were consumed by each envenomed victims.
Conclusion	The sex- & age-wise incidence of snake bite victims throw light on the vulnerable section of the population. A greater death in lower age is owing to greater amount of toxin/kg body weight. Significantly greater numbers of ASVS serum vials per victim are consumed. These areas are in risk of snake bite for two third of a year.
Key words	Snake bites, Epidemiology, Venomous, Non-venomous, Fatality, Toxin.

Introduction

Snake bite is significant public health problem in many countries with large number of envenomings and death although it is difficult to be defined the actual number of snake bite victims¹. Two regions where snake bite presents a particular problem are South East Asia and Africa. In Africa the incidence of snake bite varies greatly, from 300-500 bites per 100,000 population in forested regions to 50-100 bites per 100,000 in dry savannah and the Sahara². 70 bites per 100,000 population per year was recorded in Maharashtra, one of the states of India with the highest incidence³. A baseline epidemiological study conducted from 1980 to 1985 in 15 district hospitals in collaboration with WHO found 3189 treated

victims of whom 144 victims died i.e. CFR: 4.5 percent⁴. In Nepal, incidence of snake bite shows a distinct seasonal pattern closely related to rainfall and temperature, and snake bite is observed in all age groups, the large majorities (90%) are in males aged 11-50 years⁵. One study at the peripheral snake bite treatment centre, Damak, Eastern Nepal revealed 75 percent of the patients in the age group of 11-40 yrs.⁶ From the field based survey in Chitwan and Nawalparasi, it was found that 66 percent snake bite victims were from Nawalparasi and 44 percent from Chitwan; the maximum snake bite victims (65%) were recorded in summer and the minimum (4%) in winter. Of totality, 42 percent were venomous victims of

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which 27 percent died; 63 percent of the venomous victims were recorded from the Nawalparasi and 37 percent were from Chitwan⁷.

The maximum snake bite was found in Brahmin (45%) and minimum in Dalit and Chhetri (7% in each). Janajati caste alone occupied 41 percent of the total snake bite victims⁸.

Characterization and collation of the epidemiology of snake bite in Chitwan and Nawalparasi Districts has been essential to overcome the limitation of the community based study and also to provide the pertinent information to concerning authorities to manage the snake bite appropriately.

Methodology

The retrospective and descriptive study of snake bites in record files of Bharatpur Hospital, Bharatpur, Chitwan and Kali Gandaki Hospital, Kawaswoti, Nawalparasi conducted from 15 Sept. 2004 to 15 Sept. 2005 (Ashwin 2061 Bikram Sambat (BS) to Bhadra 2062 BS) revealed 17 months' recorded information including the study of data prior to 5 months from the commencement of the research work.

The most of people from western part of Daunne hill of Nawalparasi rush to Butwal Zonal hospital for treatment. However, majorities of snake bite victims from these districts concentrate for the treatment to these hospitals.

The Bharatpur Hospital was visited at first week and Kali Gandaki Hospital at the last week of the same month by researcher extracting data to meet up the objectives. Snake bite data record files of both hospitals were studied thoroughly to fill up 'snake bite information format'. The incidence of snake bite with respect to gender, age, caste, month, seasonal pattern,

deaths etc. were noted from record files in hospitals.

Then, all the data collected were made entry into computer system followed by data editing to detect errors, ensure accuracy, well arrangement and uniformity of data, coding to make classification and tabulation easy, classification of data in accordance with the need of objectives, tabulation for summarizing, enumerating and statistical display of data and data analysis on the basis of percentage. All the referral victims from the Kali Gandaki Hospital in Bharatpur Hospital were crosschecked during editing and coding so as to avoid redundancy of the data.

The age of the patients was classified in terms of interval 10 constructing continuous series of age up to 100 yrs. The population of two districts was extracted from population census 2001, CBS, Nepal which stated total population of Nawalparasi as 562,870 and of Chitwan as 472,048.

To determine the prevalence of snake bite, the total snake bite victims recorded in a year from both hospitals was divided by the total population of these districts. The quotient was then multiplied with the 100,000. But number of deaths within 17 months was undertaken in the calculation of deaths in terms of 100,000 population.

Results

A total of 860 snake bite victims were recorded during 17 months period (15 April, 2004 to 15 Sept., 2005 i.e. Baishak, 2061 BS to Bhadra, 2062 BS) from two-hospital survey. Of the total snake bite victims, 204 (24%) were recorded from Kali Gandaki Hospital, Nawalparasi and 656 (76%) from Bharatpur Hospital, Chitwan; 508 (59%) were from Nawalparasi and 352 (41%) were from Chitwan (Table-1).

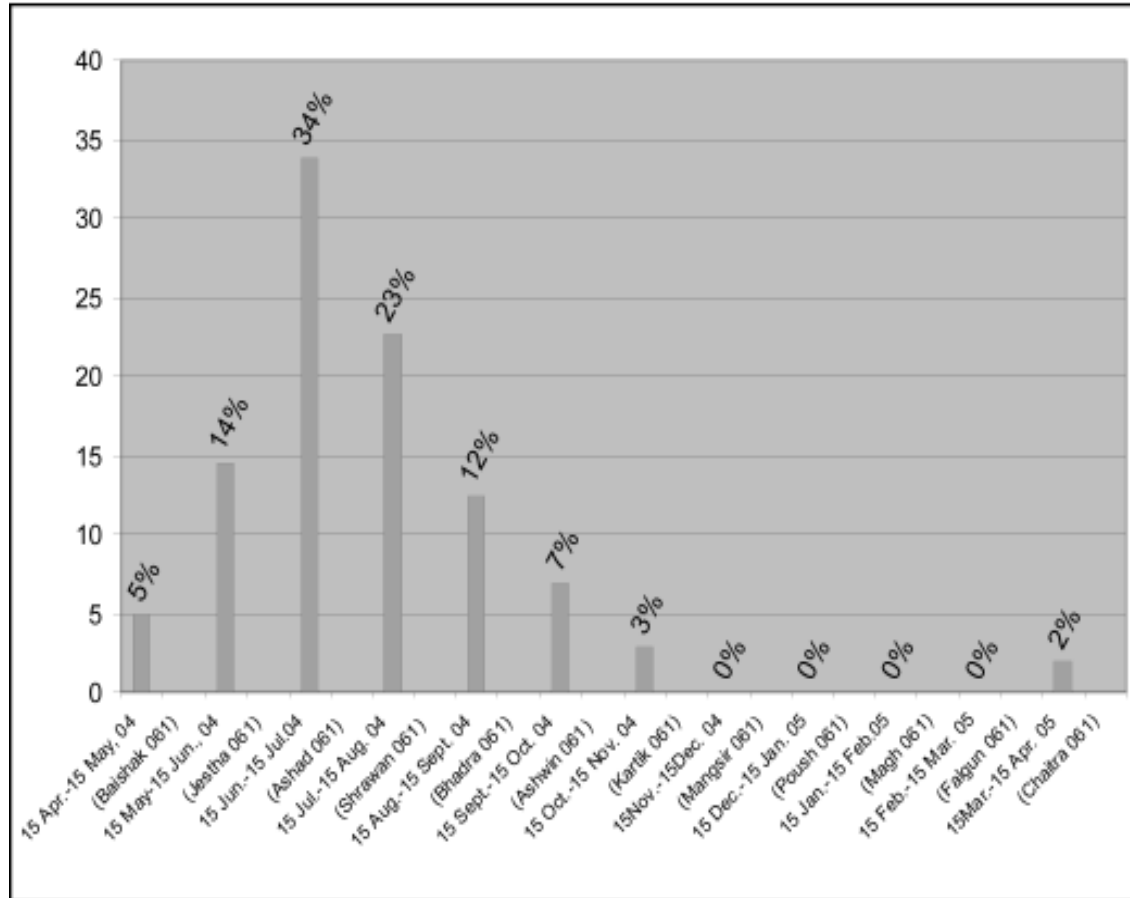
Table1: Snake bite victims with respect to hospitals, months and season

Hospital	Year (BS)	Months and Snake bite victims												To tal	Season# and Snake bite victims			
		1	2	3	4	5	6	7	8	9	10	11	12		Spring (1,2,12)	Summer (3,4,5)	Autumn (6,7,8)	Winter (9,10,11)
KGH	2061	4	18	30	35	19	5	6	0	0	0	0	0	117	22	84	11	0
	2062	1	17	33	20	16								87				
Sub-total													204					
BH	2061	18	47	122	67	37	26	7	0	0	0	0	9	333	74	226	33	0
	2062	19	50	107	82	65								323				
Sub-total													656					
Districts	Victims																	
Chitwan	352																	
Sub-total													656					
Nawalparasi	508																	
Total													860	96	310	44	0	

Within one year (15 April, 2004 to 15 April, 2005 i.e. Baishakh to Chaitra 2061 BS), a total of 450 snake bite victims were recorded of which the maximum of 152 (34%) were in 15 June to 15 July (Ashad) and

next four months starting from 15 Nov. 2004 to 15 March 2005 (Mangsir to Falgun) accounted naught snake bite victims at all in both hospitals (Figure-1).

Figure -1: Month-wise snakebite victims within a year



For the same year, the summer season alone occupied maximum snake bite victims 310 (69%) followed by spring 96 (21%), Autumn 44 (10%) and winter season accounted null snake bite victims (Table-1). Out of the 100,000 population 43 people from both districts were prone to snake bite problem per year.

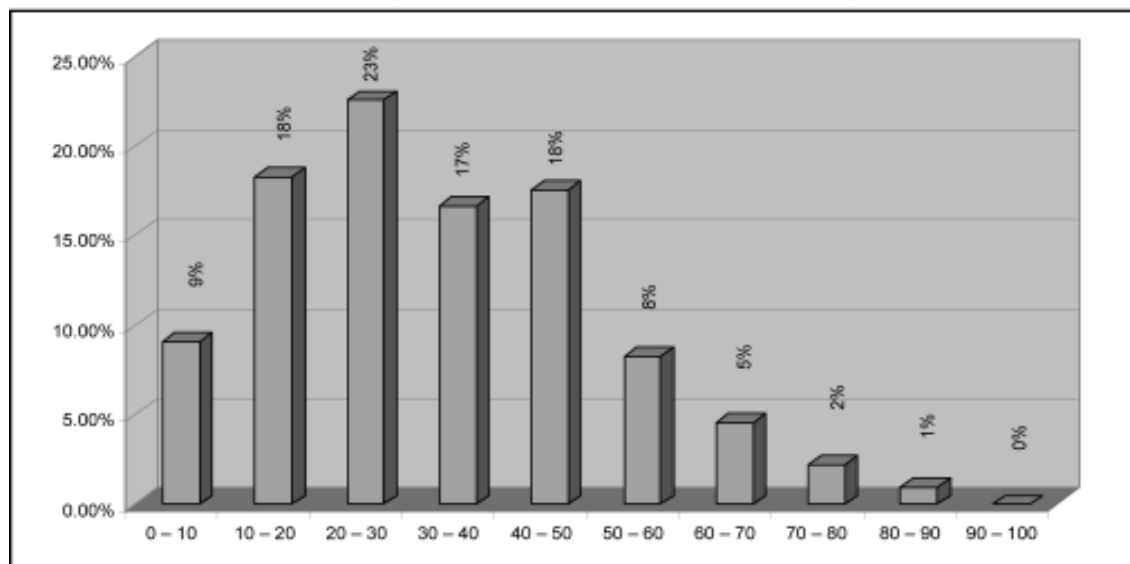
During 17 months period, 424 (49%) males and 436(51%) females of the total snake bite victims were moved toward hospital; the maximum snake bite encountered were 194 (23%) in the age group of 20 – 30 yrs. and no snake bite encountered in the age group of 90 – 100 yrs (Table-2, Figure-2).

Table 2: Age, gender, caste, biting time, biting site in body, time taken to arrive hospital and snake bite victims

1. Age	KGH		BH		Total victims	
	Victims(f)	Deaths(f)	Victims(f)	Deaths(f)		
Total deaths						
0-10	13	1	65	6	78	7
10-20	36	0	121	6	157	6
20-30	49	1	145	5	194	6
30-40	22	0	121	3	143	3
40-50	55	0	96	1	151	1
50-60	15	0	56	1	71	1
60-70	9	0	30	1	39	1
70-80	4	0	15	1	19	1
80-90	1	0	7	0	8	0
90-100	0	0	0	0	0	0
Total	204	2	656	24	860	26
2. Gender						
Male	101		323		424	
Female	103		333		436	
Total	204		656		860	
3. Caste						
Bramin	72		264		336	
Chhetri	10		93		103	
Janajati	91		213		304	
Dalit	31		86		117	
Total	204		656		860	
4. Victims						
Venomous	12	2	92	24	104	
Non-venomous	192	-	564	-	756	
Total	204		656		860	

includes data from 2061 BS only,

KGH= Kali Gandaki Hospital, BH= Bharatpur Hospital, f= frequency

Figure-2: Snakebite cases with respect to age

Out of 860 snake bite victims, the maximum of 336 (39%) were confined in Bramin followed by 304 (35%) in Janajati, 117 (14%) in Dalit and the minimum in Chhetri caste i.e. 103 (12%); 104 (12%) were venomous and 756 (88%) were non-venomous snake bite victims (Table-2). Of the total venomous victims, 26 (CFR-25%) were found dead which gives a picture of mortality of 3 people per 100,000 population owing to snake bite for both district.

An average of 32 polyvalent anti-snake venom serum (ASVS) vials prepared by Haffkine Pharmaceutical Company, Bombay, India were consumed for the treatment of each envenomed victims. The maximum ASVS vials used were 89 and minimum ASVS vials used were 6 for the treatment of single patients. It was found that the snake bite victims were treated with almost 1 anti-snake venom serum injection in Kali Gandadi Hospital because it was expensive in private hospital. Hence, venomous victims were used to be referred to the Bharatpur Hospital where merely Nepalese victims get ASVS in free of cost.

During 17 months period, a total of 26 deaths were recorded of which the greatest number of deaths (27%) was recorded in the age group of 0-10 yrs. followed by 23 percent (n=6) in age groups 10-20 yrs and 20-30 yrs., 12 percent (n=3) in the age group 30-40 yrs., 4 percent (n=1) in age groups 40-50, 50-60, 60-70, 70-80 yrs and the null deaths in the age group of 80-90. It was evident that the probability of death was the maximum at very low age-group and probability of deaths decreases gradually from lower to higher age group.

Discussion

The record of greater snake bite victims from the Bharatpur Hospital, Bhartatpur, Chitwan reflects the availability of ASVS in free of cost to Nepalese victims on the behalf of Nepal Government. However, some victims were found to be concentrated in private Kali Gandaki Hospital because of trained medical doctor's availability.

Present study recorded 59 percent snake bite victims from Nawalparasi and 41 percent from Chitwan which was supported by the previous field based study⁷. When alleged in percentage basis, snake bite was significantly higher in Nawalparasi. A bit less percentage of snake bite victims from Nawalparasi in hospital based survey than in field based survey was noticeable due to easy and quickly access of victims towards Butwal Zonal Hospital, Rupandehi district almost all from western part of Daunne hill.

In present study, out of the 100,000 population 43 people from both districts were prone to snake bite

problem per year. But field based study in the same districts recorded that 110 people per 100,000 population per year were likely to be suffered from snake bite⁷. On the other hand, the prevalence in the present study was quite higher than in Bangladesh where an annual incidence of snake bite was 4.3 bites per 100,000 populations². The prevalence recorded in present study was extremely less than the prevalence recorded in Maharashtra³ and in dry savannah and Sahara in Africa². While considering 17 months' data, 3 people per 100,000 die of snake bite in these regions. On the other hand, 12 deaths per 100,000 population per year were recorded in field based study in same area⁷. However, the prevalence of snake bite was very less than the prevalence recorded in field based survey in same districts⁷ by dint of exclusion of snake bite victims from western part of Daunne Hill in Nawalparasi.

Present study recorded maximum of snake bite victims in summer and in 15 Jun. to 15 July i.e. Ashad followed by 15 July to 15 Aug. i.e. Shrawan 15 May to 15 June i.e. Jestha (Table-1, Figure-1) which reflected the maximum field activities in agriculturally flourishing terai with hot climate, high seasonal rainfall, abundant natural vegetation, high density of rodents, rich reptiles and amphibian making ideal habitat for snake to live abundantly and human agricultural and other activities that increased the man-snake encounter leading to snake bite. This finding was supported by the similar findings of Hansdak *et al.*⁵. On the other hand, no records of snake bite victims in the next four months starting from 15 Nov. 2004 to 15 March 2005 (Mangsir to Falgun) and in winter season in both hospitals reflected the hibernation of the snakes in the period. Similar seasonal and monthly variation of snake bite was extracted from field based survey in same region⁷. From the study, it was found that two third months of a year have risk of snake bite health hazards and monthly and seasonal variation of snake bite victims reflects the optimum environment to snakes for their exposure outside and human agricultural and other activities leading into man-snake encounter.

The present study recorded more or less equal proportion of male and female snake bite victims. However, slightly higher female victims (Table-1) indicated that females had a bit more outdoor and indoor activities, which could lead them to be suffered from the snake bite and hence, they became more vulnerable to snake bite. Unlike to this result, males became more vulnerable to snake bite in field based study⁷. However, it was found that the sex-wise incidence of snake bite victims throws light on the vulnerable section of the population.

Present study recorded greater number of snake bites (75%) in the age group of 10 – 50 yrs., (Table-2, Illustration-2) which is active age group to be exposed with surrounding for several activities. It is supported by the facts brought into being by Sharma *et al*⁶. and Hansdak *et al*⁵. In present study the greatest number of snake bites was in the age group 20-30 yrs. Unlike to this result, greatest number of snake bite occurred in those 10-20 yrs. age (27%) in field based study⁷. However, from the study, it was found that the snake bite health problem was associated with exposure or activities of the people in the surroundings having inhabitation of snakes.

Present study recorded the maximum fatality rate (27%) in the age group of 0-10 yrs. followed by gradually less fatality rate among late ages which indicated the greater amount of venom per kg body weight in early ages. Hence, it was found that children below 10 yrs. age group were in risk of death due to snake bite. It was supported by the findings of Russel⁹. On the other hand, dissimilar to the findings in present study, the field based study of in same area recorded the greatest number of deaths (25%) in the age group 30 to 40 yrs⁷.

In present study, the maximum snake bite victims were recorded from the Bramin followed by Janajati, Dalit and Chhetri which was comparable to findings from field based study⁸. These data were counterpart of the population status of the respective caste in the study area. Caste-wise snake bite data could not have significant value for the snake bite management since no snakes select or prefer the caste for biting at encounters.

In present study 12 percent victims were venomous but 42 percent venomous victims were recorded in the field based study⁷. The variation of records of venomous bite might be by dint of admission of victims from western part of Daunne Hill of Nawalparasi to Butwal Zonal Hospital and of respondents' long-term memory of venomous victims than the non-venomous victims during interrogation in field. Similarly, in present study, of the total venomous victims, 25 percent were found dead which gives a picture of mortality of 3 people per 100,000 population in both district. The present picture of mortality is quite minimal than the records of 162 deaths per 100,000 population in community based study in south east Nepal². The field based study depicted 27 percent case fatality rate (CFR) when only venomous victims were considered⁷. Further, 12 deaths within 100,000 population per year were also recorded⁷. However, the almost similar mortality of people (2.4 per 100,000 per year) in

Maharashtra³ supported the picture of present mortality rate. One study in Bangladesh recorded 20 percent CFR². Unlike above result, one baseline epidemiological study in Nepal recorded 4.5 percent CFR⁴.

In present study, an average of 32 anti-snake venom serum (ASVS) vials was used for the treatment of single envenomed victims. The maximum ASVS vials used were 89 and the minimum ASVS vials used were 6 for the treatment of single envenomed victim. An average of 17.6 ASVS vials per envenomed victims was consumed. Also, 72.4 percent consumed less than 20 vials, 21.9 percent consumed 20 to 50 vials and 5.7 percent consumed more than 50 vials in Nepal¹⁰. From the study it was known that greater numbers of ASVS vials were consumed by each venomous victim in present study. Polyvalent anti- snake venom prepared in Haffkine Pharmaceutical Company, Bombay, India has been considered the only effective antidote for snake venom.

Limitation of the study

- Frequency of snake bite with respect to time of snake bite, duration of snake bite and hospital arrival, activities during snake bite, site of snake bite in body, type of biting spot, occupation could not be calculated as there was no proper and complete record in hospital record files.
- Similarly, awareness to the people for need of first aid in snake bite accident, the survivability by the first aid treatment, traditional treatment method before arrival in hospital also could not be appraised as there was no record in the hospital.
- The study could not note down the victims from the western part of Daune Hill of Nawalparasi Districts. They used to rush to Butuwal Zonal Hospital.

Conclusion

The concentration of maximum snake bite victims in Bharatur Hospital reflect the availability of ASVS vials in free of cost. When alleged in percentage basis, snake bite was significantly higher in Nawalparasi. Only two third months of a year are risk for snake bite in Chitwan and Nawalparasi. Optimum environment to snakes in terai of Nepal, greater agricultural and other outdoor and indoor activities of people at different time and hibernation of snakes in winter caused the drastic monthly and seasonal

variation of the incidence of snake bite. It was found that females were a bit more vulnerable to snake bite. The risk of snake bite amplified at age group of 10 to 50 yrs, maybe due to the greater outdoor exposure of adults. Children below the 10 yrs were in great risk of death because of greater amount of venom/kg body weight. Significantly greater numbers of ASVS vials were consumed. The inconsistency in the epidemiological data in same area in field and hospital based survey reflects variations in health reporting accuracy as well as the diversity of association of people with economy and ecology.

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References

1. Chippaux, JP. Snake bites: Appraisal of the Global Situation. *Bull. WHO*; 1998; 76(5): 515-524.
2. WHO. Blood Products and Related Biologicals: Animal sera- Available from website- http://www.who.int/bloodproducts/animal_sera/en (accessed 2005).
3. Gaitonde BB., Bhattacharya S. An Epidemiological Survey of Snake bite victims in India. *Snake*; 1980; 12:129-133.
4. WHO. Zoonotic Disease Control: Baseline Epidemiological Study on Snake bite, Treatment and Management in Nepal. *WHO weekly Epidemiol. Rev.*; 1987; 42: 319 - 20.
5. Hansdak, SG, Lallar, KS., Pokharel, P., Shyangwa, P., Karki P., Koirala SA. Clinico-epidemiological study of snake bite in Nepal. *Tropical Doctor*; 1998; 28:223-226.
6. Sharma SK., Koirala S., Dahal G., Sah C. Clinico-epidemiological features of snake bite: a study from Eastern Nepal. *Tropical. Doctor*; 2004; 34(1): 20-2.
7. Pandey, DP. Epidemiology of Snake bites Based on Field Survey in Chitwan and Nawalparasi District. Under publication in *Journal of Medical Toxicology*.
8. Pandey, DP. Epidemiology of Snake bite in Chitwan and Nawalparasi District. Research Report Submitted to University Grant Commission. 2005; 38.
9. Russell FE. Snake-venom Poisoning. Philadelphia, JB Lippincott Company; 1980; 235-285.
10. Ministry of Health, EDCD. Incidence of Poisonous Snake bite in Nepal. Cited from: *Annual Report 2002 and 2003*. 2005; 3:58-64.