

**ORIGINAL RESEARCH ARTICLE****A HOSPITAL BASED STUDY ON SNAKE BITE POISONING IN ADULTS IN THE WESTERN REGION OF NEPAL**VP Poudyal<sup>1\*</sup>, KM Paudel<sup>2</sup>, NB Rana<sup>1</sup>, S Adhikari<sup>3</sup><sup>1</sup> Department of Medicine, Lumbini Zonal Hospital, Rupandehi, Nepal<sup>2</sup> Department of paediatrics, Lumbini Zonal Hospital, Rupandehi, Nepal<sup>3</sup> Department of Obstetrics and Gynaecology, Bharatpur Hospital, Chitwan, Nepal**\*Correspondence to:** Dr. V P Poudyal, Department of Medicine, Lumbini Zonal Hospital, Rupandehi, Nepal. Email: [vishnupoudyal@gmail.com](mailto:vishnupoudyal@gmail.com)**ABSTRACT**

Snake bite poisoning is an emergency condition with significant morbidity and mortality. It is more prevalent in Terai and Inner Terai regions of Nepal especially during monsoon season. There is no study on snake bite poisoning in adults in this part of the country after the introduction of national snake bite management guideline in 2003. This retrospective study was conducted to evaluate the clinico-epidemiological profile, amount of anti-snake venom used and outcome of snake bites. Six hundred and thirty eight cases of snake bite poisoning above the age of 15 years admitted in emergency department of the hospital, over a period of 6 years from 2004/2005 to 2009/2010 were evaluated retrospectively. The study showed almost equal numbers of bites in males and females (50.3% vs 49.7%) with two third of victims of 15 to 45 years of age. Most of the poisonings (68%) was seen during June, July and August months corresponding to the monsoon season in Nepal. Majority of the victims could not identify the snakes (45%). Fingers & hands were bitten in majority cases (43%). Ptosis was observed in all cases of snake bite poisoning. About 21% of the adults had respiratory distress needing respiratory support. Average ASV used was 21.3 vials. Case fatality rate (CFR) was 11.9% with more fatality on those with respiratory distress. As mortality due to snakebite poisoning and consumption of antisnake venom is still high with the use of national protocol 2003, further study to evaluate alternate protocol is recommended.

**Key words:** Case fatality rate, Envenomation, Nepal, Poisoning, Snakebite.**DOI:** <http://dx.doi.org/10.3126/jcmc.v6i3.16697>**INTRODUCTION**

Snakebite is an environmental hazard associated with significant morbidity and mortality. It is an important medical emergency and cause of significant numbers of hospital admissions in many parts of the South East Asian region<sup>1</sup>. The incidence of bites is high in warm regions, where snakes are abundant and economic activities are mainly agricultural<sup>2</sup>. It is difficult to know the actual number of morbidity and mortality of snake bites as these events are not systematically reported in most countries and very few countries possess a reliable epidemiological reporting system. It is estimated that the incidence of snake envenomation in the world can exceed 5 million per year with an associated mortality rate of 125000 persons per year<sup>2</sup>. South Asian, Southeast

Asian, and sub-Sahara African countries are the places with highest burden of snake bites<sup>3</sup>. It has been estimated that four million snakebites occur each year in Asia alone, of which approximately 50% are envenomed, resulting in 1, 00,000 annual deaths<sup>2</sup>. Among 3,000 known species of snakes in the world, around 300 are poisonous to humans<sup>4</sup>.

In Nepal, a total of 77 species of snakes including 22 poisonous types have been reported so far. The most commonly found poisonous snakes include 4 species of krait, 3 species of cobra, 9 species of viper, 1 species each of coral snake, Himalayan pit viper, mountain pit viper and Russell's viper. The commonest poisonous snakes in the terai and inner-terai regions of Nepal are Cobras and Kraits<sup>5</sup>.

In Nepal, it is estimated that at least 20,000 snake bites occur each year with about 1000 deaths in hospitals, mainly in the Terai region<sup>6</sup>. A community based study<sup>7</sup> in Nepal showed the annual mortality from snake bite to be 162 per 100000 populations. Nepal did not have proper guidelines for anti-snake venom use in the past. Different doctors and medical persons managed snake bites differently even within the same hospital. The need of protocol was realized by all health workers. Therefore, the protocol for the management of snake bites was developed and introduced in Nepal in 2003<sup>8</sup>. Based on the few studies done in various parts of Nepal, the case fatality rate of poisonous snake bites ranged from 3 to 58% before the introduction of the national protocol in 2003<sup>5,7,9-13</sup>.

India had introduced a national protocol<sup>14</sup> for management of snake bites in 2007. This protocol recommended giving anti-snake venom mainly during first three hours. It has been reported that the mortality as well as the consumption of anti-snake venom have decreased after the implementation of this new Indian protocol<sup>15</sup>. Similar guideline was also developed and recommended by World Health Organization for the management of snake bites in Southeast Asia region<sup>16</sup>.

The outcome of snake bites has not been studied in this part of Nepal after the introduction of the national protocol. This study was, therefore, conducted to evaluate the clinico-epidemiological profile, amount of anti-snake venom used and outcome of snake bites in adults admitted in Lumbini Zonal Hospital.

## MATERIALS AND METHODS

A retrospective study was conducted on snake bite patients treated at Lumbini Zonal Hospital in Butwal which is a referral hospital of this area with 134 beds and specialist services. The data were collected from the records over 6 years (July/August 2004 to June/July 2010) of the patients admitted in emergency ward of the hospital.

The patients were managed by the team that comprised of medical officers, physicians, and paramedical staffs. Emergency department is equipped with an electrocardiogram machine, pulse-oximeter, oxygen cylinders, emergency drugs, and

resuscitation equipments including endotracheal intubation sets. Anti-snake venom used in this ward is made in India from Haffkine Pharmaceutical Company, Bombay and it is available in emergency department throughout the year.

The details of each case were taken from patients' case records. The variables used were most common snake species, gender, the age of victims, the time and site of bite, the symptoms noticed on hospital admission, the treatment instituted, number of ASV used, and the final outcome. The data were entered in a computer database and analyzed using excel.

The diagnosis of snake-bite was established on the basis of a history of snake-bite with examination of the killed snake when available, recognition of the snakes by patients and bystanders and clinical manifestations.

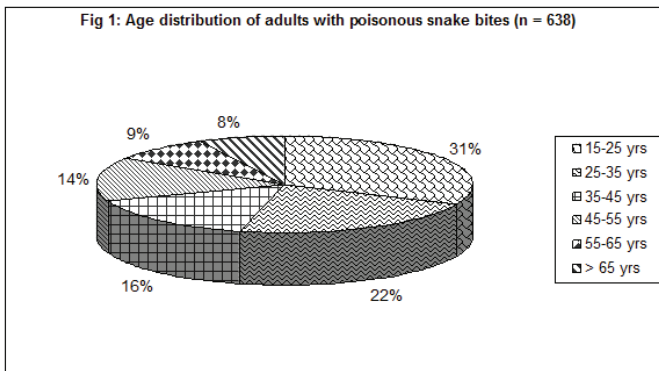
Snake bite victims were observed in emergency department and those who didn't develop signs of envenomation after 8 hours of bite were discharged. Patients were examined with particular attention to their vital signs and evidence of neurotoxicity like ptosis, external ophthalmoplegia, respiratory paralysis and any signs of hemotoxic poisoning.

Envenomed patients were treated according to national guidelines recommended by epidemiology and disease control division (EDCD) in 2003. Two vials of polyvalent anti-snake venom (ASV) serum were given bolus followed by intravenous infusion of 4 vials 4 to 6 hourly to patients with signs of envenomation. Patients were closely observed for evidence of early antivenom reactions and managed accordingly. Endotracheal intubation was performed as soon as patients showed signs of respiratory paralysis, and ventilation was assisted. As intensive care unit (ICU) with mechanical ventilators were not available in hospital, intubated patients were managed with bag and mask ventilation by patients' relatives in emergency department. Few patients who could manage to go elsewhere for ICU management were referred. After clinical improvement patients were extubated and were shifted to the wards and antivenom was gradually tapered and stopped. Patients were discharged after ophthalmoplegia, ptoses had completely subsided and when they were clinically stable. Patients who were brought dead with history of snake bites were

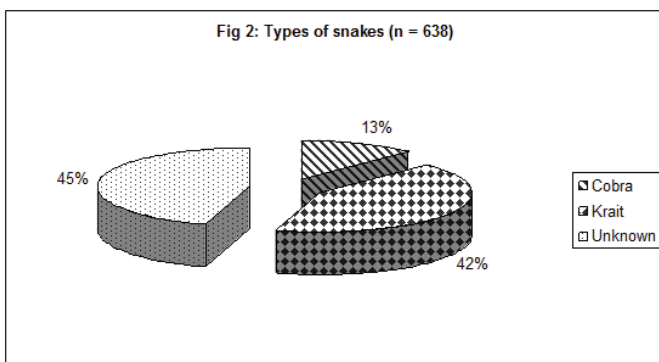
excluded from the study.

**RESULTS**

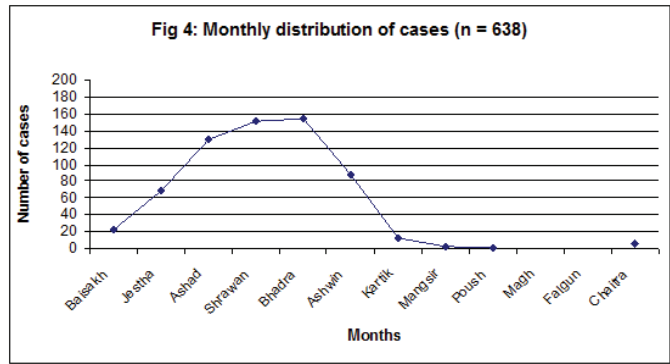
Total snake bite cases recorded at Lumbini Zonal Hospital during the study period were 6520, out of which 889 (13.6%) developed signs and symptoms of envenomation. Among the poisonous bites; adults (above 15 years) comprised 643 (72.3 %) cases. Out of 643 cases recorded; 5 cases were recorded as brought dead and excluded from the study. Eighteen victims were referred to other centers with ICU facility. Female victims (n=321) were almost equal to males (n=317) in this study (50.3% vs. 49.7%). About two third of snake bite victims were of age 15 to 45 yrs as shown in figure 1.



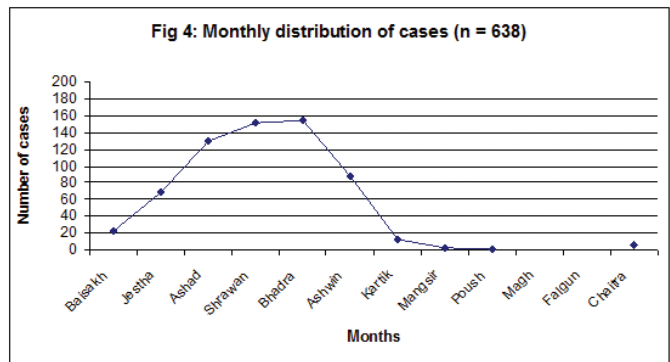
Majority of snakes responsible for bites in the study were unknown (45 %) followed by Krait (42%) as shown in figure 2.



It is seen in the figure 3 that about 43% of the bites occurred in upper limbs and only in a few cases (11.3%) the bite sites remained unknown.



It is shown in the figure 4 that most of the poisonous cases occurred in the monsoon season corresponding to June to August.

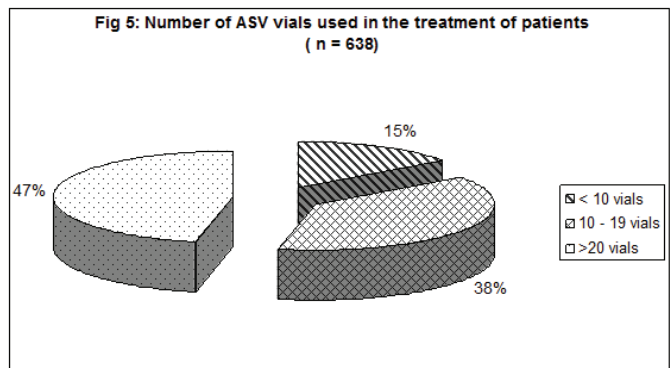


**Table 1: Clinical presentations of cases (n=638)**

Signs & symptoms*	No of cases	%
Ptosis	638	100
Dysphagia	178	27.9
Respiratory Distress	136	21.3
Pain Abdomen	81	12.7

\* Cases had one or more signs or symptoms

As shown in table 1 all cases had ptosis as a sign of poisoning and only a few cases had pain abdomen. No vasculotoxic cases were found in case records.



The number of ASV used ranged from 1 to 95 vials with the average of 21.35 vials. Interestingly, one victim who needed 95 vials survived. As shown in figure 5 about half of the envenomed victims consumed more than 20 vials of anti snake venom serum.

**Table 2: Case fatality in children and adults**

Age group	No of poisonous bites	No of deaths	Case fatality rate (%)	Total case Fatality Rate (%)	Childhood case fatality (of total)
1-14 yrs	246	68	27.64	16.1	47.9
>15 yrs	638	74	11.9		
Total	884	142			

As seen in the table, the case fatality rate among adults is 11.9% and contributed almost half of the case fatality due to snake bites in the hospital. Few referred cases (n=18) were not taken as denominator in mortality calculation. Out of 74 deaths 44 (more than 50%) were those who had presented with respiratory distress and needed ventilator support. Number of anaphylactic reactions to antivenoms could not be noted from case records.

Most of the bites (around 66%) occurred during the period of 6 pm to 6 am. Likewise, most of the cases (66.6%) were brought to hospital within 4 hours of bites.

## DISCUSSION

Present study showed that most of the bites occurred in 15-45 age groups which are in agreement with other studies<sup>10, 13, 17</sup>. This could be due to the fact that people of that age range, especially in rural communities have to carry out outdoor activities like firewood-collecting, grass-cutting, and looking after the cattle in the fields and field-working exposing them to snakebites.

Almost equal occurrence of bites in males and females observed in this study is comparable with the previous study<sup>12</sup>. This observation could be due to the fact that males and females are traditionally equally involved in field activities in poor farmers' communities. Moreover, both genders could suffer night time bites.

In this study, the highest incidence of snakebite poi-

soning was seen during the months of June, July and August which corresponds to the monsoon season in Nepal. This is also a hot season and the snakes come out of their shelter due to increased humidity and temperature. This seasonal pattern of poisoning was seen in other studies as well<sup>5,9,12,18,19</sup>.

The majority of the adults in this study could not identify the biting snakes. This is possibly because of people working in fields with bunches of grasses where snakes could be hiding and also bites mainly occurring during night. This finding is similar to one study<sup>5</sup> and contrasts with other study where 61% victims had identified snakes with 58% being cobra<sup>7</sup>.

Biting sites were the fingers and hands in about 43% of the cases in our study. This finding is comparable to previous studies<sup>5,18</sup>. This is possible because the adults may touch the snakes while cutting the grass where the poisonous snakes can hide in. Some of the earlier studies found lower extremities to be the most frequently bitten sites<sup>1,9,10,17</sup>. The explanation given by the authors was that the snakes had been accidentally stamped while walking.

The commonest clinical finding in the present study was ptosis as it was taken as the gold standard for the confirmation of poisonous neurotoxic bite and start of antsnake venom. Ptosis is easily noticeable sign both by the patients and the health workers. Respiratory distress was observed in approximately 1/5th of victims and a large majority of them needed respiratory support and had poor outcome. Around 1/3<sup>rd</sup> of victims who needed respiratory support died. Respiratory distress occurs mostly as a result of

paralysis of muscles of respiration by the neurotoxin and develops only after ptosis has developed. When the treatment of the poisoning is either too much delayed or inadequate after ptosis has been observed, possibility of developing respiratory distress is increased leading to increased mortality.

In the present study, majority of victims (47%) needed more than 20 vials of ASV during treatment. The average number of vials of ASV used during treatment was 21.3 per case. This is comparable to another study where the number of vials used was 19.6 per case<sup>17</sup>. This could be due to the fact that victims were given antsnake venom till complete reversal of ptosis and extubation in case of intubated victims. As it could take long time in case of krait bite for reversal of ptosis, it could increase the use of ASV.

The total case fatality rate observed in this study (11.9%) also falls in the range of mortality of 3 to 58% found in previous studies of Nepal but it contrasts with other studies which had less than 7% of case fatalities<sup>20, 21, 22,23,24</sup>. This could be due to the fact that in those studies ASV were used in high doses (>10 vials) in first hour along with ICU facility available in their centres for intubated patients.

Venom from the Elapids is neurotoxic as it blocks the transmission of nerve impulse from the neuromuscular junction<sup>4</sup>. Venoms should be neutralised as early as possible before they are fixed to neuromuscular junction causing respiratory paralysis. ASV is of no use once victims are intubated with respiratory paralysis and more than 25 vials are not needed in neurotoxic poisoning<sup>14</sup>. Antivenom is most effective if delivered within 4 hours of the bite and is of little value if administration is delayed beyond 12 hours<sup>4</sup>.

In India, in 2007, a new national protocol<sup>14</sup> was developed with the concept of aggressive use of antsnake venom within 3 hours of the development of first sign of envenomation, ptosis. It is argued that the use of ASV after the development of respiratory paralysis is not beneficial. The use of new protocol resulted in a 66% decline in the amount of ASV administered to victims and the case fatality rate were found to be decreased by 24%<sup>15</sup>.

Cases with neurotoxic poisoning with respiratory

paralysis need respiratory support in intensive care unit (ICU) set up. As ICU set up was not present in our hospital and intubated patients were bagged by patient parties themselves, the ventilation techniques could be not perfect. This might have lead to more mortality in our setting as most of the fatality was amongst intubated victims with respiratory paralysis.

Although this was a retrospective hospital based study, this descriptive study is hoped to yield epidemiological statistics and information on clinical manifestations and hospital management of the snake bite cases and serve to generate hypotheses for future studies.

## CONCLUSION AND RECOMMENDATION

Majority of snake bite poisoning in our region is neurotoxic, which may cause respiratory paralysis and may need ventilatory support. So, management of cases in ICU set up is recommended.

Further study is recommended in our part of the country to evaluate the protocol recommended by WHO in 2010 for Southeast Asia region which considers the aggressive anti snake venom use within first few hours of envenomation.

## ACKNOWLEDGMENT

I would like to thank Medical Superintendent for allowing me to review the record files. I am thankful to Medical Record Officer, Mr. Laxmi Raj Regmi for his help in data review and Mr. Ram Bahadur Malla for his secretarial help.

## REFERENCES

1. Warrell DA. WHO/SEARO Guidelines for the clinical management of snake bites in the Southeast Asian region. South East Asian J Trop Med Publ Hlth. 1999; 30: 1–83.
2. Chippaux J-P. Snake-bites: appraisal of the global situation. Bull WHO 1998; 76(5):515-24.
3. Kasturiratne A, Wickremasinghe AR, de Silva N, Gunawardena NK, Pathmeswaran A, et al. The global burden of snakebite: a literature analysis and modelling based on regional estimates of envenoming and deaths. PloS Med 2008; 5(11):218.

4. Holve S. Envenomations: In Behrman RE, Kliegman RM and Jenson HB, Stanton BF. Nelson Textbook of Pediatrics. 18 th edn, W.B. Saunders Company. 2007: 2932 - 35.
5. Incidence of poisonous snakebite in Nepal. Annual Report. Epidemiology and Disease Control Division, Ministry of Health, Gov of Nepal. 2001:63-71.
6. WHO. Zoonotic Disease Control: Baseline Epidemiology Study on Snakebite, Treatment and Management in Nepal. WHO weekly epidemiology. Rev;1987; 42:319-20.
7. Sharma SK, Chappuis F, Jha N, Bovier PA, Loutan L, Koirala S. Impact of snake bites and determinants of fatal outcomes in southeastern Nepal. Am J Trop Med Hyg. 2004; 71(2):234-8.
8. Shah, K. B., Shrestha, J. M., and Thapa C. L. Snakebite Management Guideline. Department of Health Services Epidemiology and Disease Control Division Zoonoses Control Sub-Section. 2003: 1-53.
9. Hansdak, SG, Lallar, KS, Pokharel, P., Shyangwa, P., Karki P., Koirala SA. Clinico-epidemiological study of snakebite in Nepal. Trop. Doctr, 2004; 34(1):20-2.
10. Pandey DP, Thapa CL, Hamal PK. Impact of First Aid Training in Management of Snake Bite Victims in Madi Valley. J Nepal Health Res Council 2010; 8(16):5-9.
11. Heap BJ, Cowan GO. The epidemiology of snakebite presenting to British Military Hospital Dharan during 1989. JR Army Med Corps, 1991; 137: 123 - 125.
12. Pandey, DP. Epidemiology of Snake Bites Based on Hospital Survey in Chitwan and Nawalparasi Districts, Nepal. J Nep Health Research Council 2006; 4:51-57.
13. Sharma SK, Khanal B, Pokhrel P, Khan A, Koirala S (2003) Snakebite-reappraisal of the situation in eastern Nepal. Toxicon 41: 285–289.
14. Indian National Snakebite Protocols. 2007:13-21.
15. Ghosh S; Maisnam I, Murmu B K, Mitra P K, Roy A, Simpson I D. A Locally Developed Snakebite Management Protocol Significantly Reduces Overall Anti Snake Venom Utilization in West Bengal, India Wilderness and Environmental Medicine 2008; 19: 267- 274.
16. Warrell DA, 2010. WHO/SEARO Guidelines for the clinical management of snake bites in the southeast Asian region.
17. Devkota UN, Steinman JP, Kathayat JB. Epidemiology of snakebite; A study from Choharwa Army Camp, Siraha, Nepal. Journal of the Nepal Medical Association (JNMA ). 2001, 40; 57-62.
18. Devkota, U. N.; Steinmann, J. P.; Shah, L. N. Snakebite in Nepal: a study from Siraha district. Journal of the Nepal Medical Association 2000; 39(134):203-209.
19. Joshi DD. An Epidemiological Study of Snake Bite Cases in Children of Nepal. J Nep Paedtr Soc. 2010; 30(3):135-140.
20. Singh J, Bhoi S, Gupta V, Goel A. Clinical profile of venomous snake bites in north Indian military hospital. J Emerg Trauma Shock. 2008; 1:78-80.
21. Christeine A. Ariaratnam, M. H. Rezvi Sheriff, R. David G. Theakston, and David A. Warrell. Distinctive Epidemiologic and Clinical Features of Common Krait (*Bungarus caeruleus*) Bites in Sri Lanka. Am. J. Trop. Med. Hyg. 2008; 79(3): 458–462.
22. S A M Kularatne. Common krait (*Bungarus caeruleus*) bite in Anuradhapura, Sri Lanka: a prospective clinical study, 1996–98. Postgrad Med J. 2002; 78:276-280.
23. Gold BS, Wingert WA. Snake venom poisoning in the United States: a review of therapeutic practice. South Med J. 1994; 87(6):579-89.
24. Abu Bakar, Nazmul Ahasan, Manwar Ahsan. Snake bite in Bangladesh. 2006; 1(3).