ELSEVIER

Toxicon 41 (2003) 285–289

TOXICON

www.elsevier.com/locate/toxicon

Snakebite-reappraisal of the situation in Eastern Nepal

Sanjib Kumar Sharma[a,*], Basudha Khanal[b], Parash Pokhrel[c], Ajmal Khan[a], Shekhar Koirala[a]

[a]*Department of Medicine, BP Koirala Institute of Health Sciences, Dharan, Nepal*
[b]*Department of Microbiology, BP Koirala Institute of Health Sciences, Dharan, Nepal*
[c]*Department of Community Medicine, BP Koirala Institute of Health Sciences, Dharan, Nepal*

Received 2 May 2002; accepted 25 September 2002

Abstract

Four thousand and seventy eight cases of snakebite, occurring between January and December 2000, were analysed for clinical and epidemiological features. Cases of about 379 had features of envenoming and 81 died. All the victims with systemic envenoming had neurotoxicity. No case with coagulopathy was recorded. Snakebite was more frequent between the ages of 10 and 40 years (76%) and in males (73%). The majority (80%) of the snakebites were observed during the monsoon. Seventy percent of the bites with clinical features of envenoming occurred between 1400 and 2200 h. Five thousand eight hundred and fifty nine vials of polyvalent antisnake venom were used. Case fatality rate varied in the ten centres surveyed. It was as low as 3% in some to as high as 58% in others. Overall death rate among all snakebite cases was 2%.

Keywords: Snakebite; Eastern Nepal; Neurotoxicity; Antisnake venom; Mortality

1. Introduction

Nepal is located along the southern slope of the Himalayan Mountains and lies between 80°04′ and 88°12′ longitude and 26°22′ and 30°27′ latitude. It is divided into three geographical regions, namely mountains, hills and terai (plains). The terai region covers 23% of the total land area and accommodates 40–42% of the total population of Nepal. Seventeen percent of the land area is agriculturally cultivated and 39% is forest area. Ninty one percent of the population is in rural areas and agriculture is the mainstay of the Nepalese economy. It absorbs 91% of the labour force.

During the monsoon from June to October, the temperature varies between 22.2 and 35.6 °C. This is the time for paddy plantation, jute cultivation, weeding and harvesting in Nepal.

Snakebite is an important problem in rural populations of this primarily agrarian society. A baseline epidemiological survey was conducted between 1980 and 1985 by the ministry of health in collaboration with the World Health Organisation (World Health Organisation, 1987). During the study period, 3189 cases of snakebite with 144 deaths were recorded from 15 district hospitals. Overall death rate among all the cases of snakebite was 4.5%. Since then little has been published on the problem of snakebite in Nepal in spite of the high mortality and morbidity due to snakebite in this country (Hansdak et al, 1998; Heap and Cowan, 1991). Our study was carried out to review the problems of snakebite in Eastern Nepal.

2. Materials and methods

Snakebite case records of the year 2000 from January to December were reviewed and analysed. The centres included in the survey were one teaching hospital, three zonal hospitals, four district hospitals and two snakebite treatment centres. The data were obtained from the admission register, and snakebite case record sheets were then retrieved from the medical record section of each

* Corresponding author. Fax: +977-25-20251.
E-mail address: drsanjib@yahoo.com (S.K. Sharma).

0041-0101/03/$ - see front matter © 2003 Elsevier Science Ltd. All rights reserved.
PII: S0041-0101(02)00289-1

hospital by personal visit to the centre by the team of investigators. The details of management were discussed with the emergency doctors and staff involved in the management of snakebite. The profiles of the patient were carefully studied to avoid duplication in cases of referral of the patient from one centre to another. Data were analysed for clinico-epidemiological profile, case fatality rate (CFR) difference in various hospitals, and requirement of antisnake venom (ASV). The requirement of ASV was recorded from case record sheets. The indication of ASV was looked into carefully according to current guidelines (Warrell, 1999) by analysing symptoms and signs that were recorded. Results were also compared with the baseline epidemiological survey to find out whether there is changing incidence of the snakebite reported.

3. Results

During the one year study period 4078 cases of snakebite were recorded. Three hundred and seventy nine patients were found to have features of envenoming. A male preponderance (73%) was observed among all the cases. However, among cases with envenoming, 55% were males and 45% were females.

Snakebite was most common in the age group of 10–40 years, which constituted 76% of the total patients (Fig. 1).

The highest numbers of the snakebite cases (80%) were recorded during the monsoon season from June to October. Among the patients with features of envenoming, 82% were recorded during this period. However, even in the cold month of December two victims with systemic envenoming were noted (Fig. 2).

Time taken by the victim to report to the treatment centre was analysed among patients with envenoming. Data of patients where either time of bite or arrival was not mentioned were excluded from the study. Twenty four percent ($n = 81$) of victims reported within one hour while 2–3 h were taken by 37% of the victims. Death rate was higher with patients who arrived late in hospital (Fig. 3).

A total of 1265 victims or bystander had seen the snake. One hundred and twenty six of them claimed that they could identify the snake. Snakes identified by them were cobra (43), green pit viper (35), krait (25), mountain pit viper (11) rat snake (8) and water snake (4). Killed snakes were brought along with 41 patients and those were identified at treatment centres as cobra (14), green pit viper (11), krait (9), paradise tree snake (5) and rat snake (2).

The majority of the patients (65%) sustained bites in the lower limb, while 32% ($n = 1146$) were bitten in upper extremities. One hundred and thirty people had been bitten either on the face, head, neck, body or buttock.

One hundred and thirty five out of 333 cases with features of envenoming (40.5%) were bitten between 1400 and 1800 h, followed by 29% between 1800 and 2200 h. Eight percent of the patients sustained bite during sleep at night.

Thirty six patients had features of local envenoming only and rest of the victims had neurological features of envenoming. Coagulopathy was not recorded in any of these patients. Out of 57 cases identified as bitten by cobra, 24 patients had features of both local and systemic envenoming. Blister formation was recorded in four patients.

Requirement for ASV was noticed to vary widely, from two vials, presumably in a case of green pit viper (genus: *Trimeresurus*) bite to 115 vials in a case of common krait (Genus: *Bungarus*) bite. Six to 15 vials of polyvalent antisnake venom were used in 44% of the victims, followed

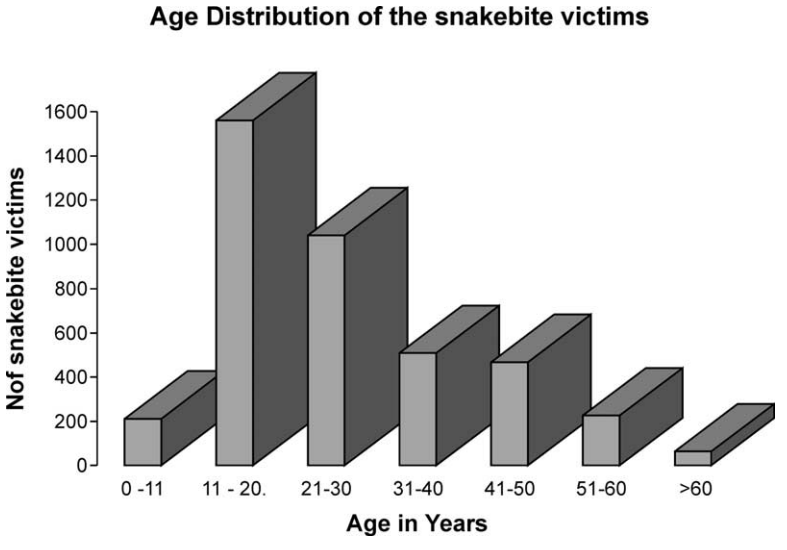

Fig. 1.

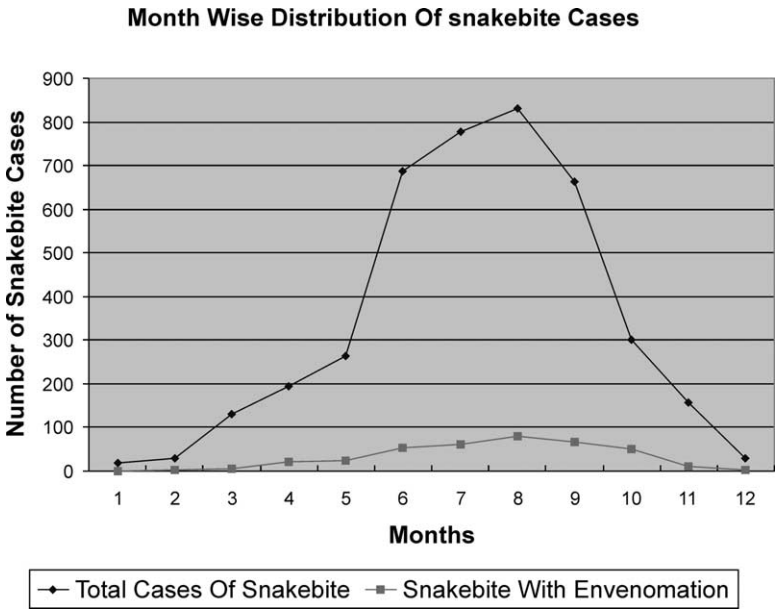

Fig. 2.

by 16–24 vials in 24%. More than 25 vials were used in 16% of the cases. Five or less vials were used in 61 cases, of which 25 were recorded as bite due to green pit viper and in 12 patients having features neurotoxic envenoming. Thirteen patients did not have definitive indication for use of ASV. Total requirement of polyvalent ASV in these hospitals in 1 year was 5859 vials.

CFR varied from centre to centre as shown in Table 1.

4. Discussion

Snakebite is an important and serious medical problem throughout the entire terai region of Nepal. This region has about 40% of the population of Nepal. They are at risk of snakebite mostly in rural areas. The exact incidence and, thereby, the extent of the burden of the disease can be known from community based studies. An increase in the number of cases is reflected in the present study as 4078

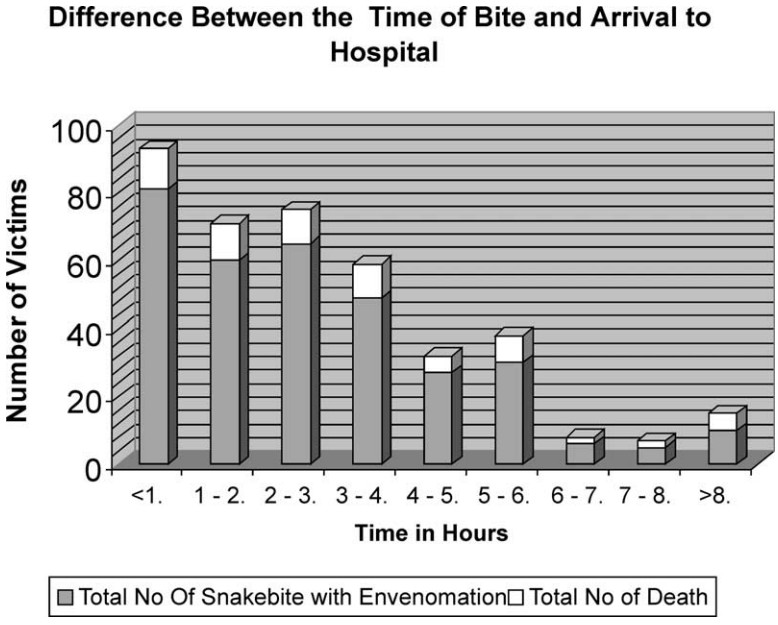

Fig. 3.

Table 1
Morbidity and CFR in different hospitals

Name of the hospital	Total cases of snake bite	Cases with envenomation	Death	CFR	Death among all cases of snakebite (%)
BPKIHS[a]	281	30	5	16.66	1.78
Koshi[b]	591	28	6	21.4	1.01
Sagarmatha[b]	530	48	28	58.33	5.28
Janakpur[b]	314	56	9	16.07	2.8
Rangeli[c]	144	10	2	20	1.38
Inurua[c]	287	11	4	36.36	1.39
Siraha[c]	341	20	11	55	3.22
Lahan[c]	357	39	10	25.64	2.8
Charali[d]	629	66	4	6.06	0.63
Damak[e]	604	71	2	2.82	0.33
Total	4078	379	81	21.37	1.98

[a] BP Koirala Institute of Health Sciences—a tertiary referral and teaching hospital.
[b] Zonal hospital.
[c] District hospitals.
[d] Charali army barrack—centre involved in snakebite treatment.
[e] Snake bite treatment centre, Damak Red Cross subcentre (details of the work from this centre is submitted for the publication).

cases were recorded in 1 year from the 10 hospitals (407 cases/hospital/year) in comparison to 3189 cases during 1980–85 from 15 hospitals (42 cases/hospitals/year) in the baseline study (World Health Organisation, 1987). On the other hand, overall death among all the patients of snakebite has decreased to 2% from 4.5%, though the mortality among the patients with envenomation could not be compared due to nonavailability of a number of cases with envenoming in the previous study. The baseline survey was carried out in 15 hospitals of terai region of Nepal for clinico-epidemiological features and treatment of snakebite. Increase in the number of the patients seeking medical help could be due to awareness of availability of treatment facilities in these outlets. Encroachment of the forests and vegetation, thereby invasion of natural habitant of reptiles may be another reason.

Involvement of the 10 to 40 years (76%) age group reflects an active population at risk and is similar to previous studies (World Health Organisation, 1987; Heap and Cowan, 1991; Nhachi and Kasilo, 1994). Male preponderance reflects on the outdoor activities of males in the society. Higher incidence of snakebite in males has been recorded in other studies also, though male to female ratios varied (Heap and Cowan, 1991; Malay et al., 1986; Buranasin, 1993). It is likely that the majority of the victims were either farmers or housewives in a primarily agrarian society of Nepal. A seasonal variation of snakebite was observed in the present study. Most (80%) of the bites had occurred during the monsoon from June to October. Eighty two percent of the snakebites with envenoming were recorded during this period. Most of the agricultural field activities and compulsion of the reptiles to come out of their shelter during the rainy and summer season is likely to be responsible for the seasonally higher incidence of bites. Similar association with higher rainfall has been reported from India and Zimbabwe (Nhachi and Kasilo, 1994; Lal et al., 2001). The majority (65%) of the victims sustained bite in lower extremities. This may be because the snakes were inadvertently trodden upon most of the time. Bites in the head and neck region may occur during sleep on ground as kraits often enter human dwelling at night in search of food. Similar observation was made in the study by Ministry of Health in the past (World Health Organisation, 1987). Although, it was recorded that 31% ($n = 1265$) of the victims or the bystander had seen and 126 of them had identified the biting species of the snake, it did not help in the management, as many of the commonly seen non-poisonous snakes even at close observation appear poisonous and vice versa, (Forsythe-Jauch, 1975). However, the identification of killed snakes was useful to know the snakes commonly found in Eastern Nepal.

Except from the single centre, majority of the patients (92%) with recorded envenoming had neurotoxic symptoms. No patients had coagulation abnormalities. Features of local envenomation were recorded in cobra bite including blister formation, which is known to occur. However, due to nature of the study, sequelea of the local wound after the discharge was not available. Among the 14 venomous species of snakes of Nepal, cobra (Genus: *Naja*) and kraits (Genus: *Bungarus*) are the two important genera found in Eastern Nepal (Bhetwal et al., 1998). Therefore, the clinical features of the systemic envenoming were entirely neurotoxic. However, features of local envenoming may also occur due to green pit vipers that are often seen in hill areas of Eastern Nepal.

Sizeable numbers of the patients sought medical attention within a short period of time in this analysis. Similar observations were also made in the past studies done in Nepal (World Health Organisation, 1987; Heap and

Cowan, 1991). However, detailed analysis of the present data revealed that the victims reporting within 3 h of bite (58%) were the residents within 10 km of the nearby treatment centres. Motorable roads also connected them to the treatment centre making it possible for them to reach hospital relatively early. However, lack of transport facilities and inability to afford transportation led to delay or inability in seeking medical treatment in a large number of the victims. It may lead to respiratory failure and death. This may have been one of the reasons of high death rate in patients arriving late to the hospital in the present study. Delayed arrival in the hospital was one of the major causes of the death in the study done by Looareesuwan et al. (1998). Visit to traditional healers and unawareness of the effective medical management of snakebite may be other reasons for delayed arrival to the hospital in certain group of the victims.

The only scientifically and medically approved treatment of envenoming by snakes is the use of intravenously administered ASV. About 3000 vials of polyvalent ASV is imported to Nepal from India (World Health Organisation, 1987; Bhetwal et al., 1998). Requirement of around 5859 vials of polyvalent ASV in 10 hospitals of Eastern Nepal points to the increasing demand of antivenom. As antivenom is costly and is not affordable to many rural people from outside market, and of limited supply besides carrying a risk of severe adverse reaction, it should be used judiciously only in cases with clear signs of envenoming (Warrell, 1999). Records of reversal of signs of systemic envenoming in certain victims even with less than 5 vials of polyvalent ASV, routine use of it in green pit viper bite and use of ASV without definite indication in some cases in present survey may be pointers towards unnecessary use of ASV. Adherence to available standard guidelines, and proper training of health workers on snakebite management will help to prevent unnecessary and haphazard use of ASV. CFR due to snakebite ranged from 3 to 58% in various hospitals. CFR from various centres of Asia, Europe and Africa were reported to range from 0.4 to 54, 0.1 to 1.8 and 0.1 to 28%, respectively (Chippaux, 1998). The significant differences in the CFR among various centres may be due to lack of a national protocol, use of small bolus doses of ASV in certain centres, short supply of ASV, nonavailability of physical facilities, and lack of trained manpower in the management of snakebite.

5. Conclusion

The increasing number of snakebites reported in Eastern Nepal is alarming. The actual incidence and magnitude of the problem would be known from community-based survey. Morphological and other advanced immunodiagnostic techniques will be useful for rapid diagnosis and identification of species of reptiles. There is gross disparity in the management and outcome of snakebite in different hospitals. Training of the personnel engaged in the emergency healthcare management, adherence to the available standard protocol, development of national guidelines based on the clinical trials would help to eliminate this disparity and result in effective management of snakebite. In Eastern Nepal, where snakebite is most prevalent, none of the required conditions for its management was fulfilled. Efforts are needed to develop studies on the epidemiology of snakebite, education of the population at risk, improving the distribution and availability of antivenom, and training of healthcare personnel in management of snakebite, a task that our institute has initiated with the hope to mitigate the problem of morbidity and mortality due to snakebite in this region.

References

Bhetwal, B.B., O'Shea, M., Warrell, D.A., 1998. Snakes and snakebite in Nepal. Tropical Doctor 28, 193–194. (Editorial).

Buranasin, P., 1993. Snakebite at Maharat nakhon ratchasima regional hospital. Southeast Asian Journal of Tropical Medicine and Public Health 24, 186–192.

Chippaux, J.P., 1998. Snakebite: appraisal of the global situation. Bulletin of World Health Organisation 76 (5), 515–524.

Forsythe-Jauch, W.E.J., 1975. A series of snakes bite. Journal of the Royal Army Medical Corps 121, 23–28.

Hansdak, G., Lallar, K.S., Pokharel, P., Syangwa, P., Karki, P., Koirala, S., 1998. A clinico-epidemiological study of snakebite in Nepal. Tropical Doctor 28, 223–226.

Heap, B.J., Cowan, G.O., 1991. The epidemiology of snakebite presenting to British Military Hospital Dharan during 1989. Journal of the Royal Army Medical Corps 137, 123–125.

Lal, P., Dutta, S., Rott, S.B., Dhanabalam, M., Kumar, A., 2001. Epidemiological profile of snakebite cases admitted in JIPMER hospital. Indian Journal of Community Medicine 26, 36–38.

Looareesuwan, S., Viravan, C., Warrell, D.A., 1998. Factors contributing to fatal snakebite in rural tropics: analysis of 46 cases in Thailand. Transection of the Royal Society of Tropical Medicine and Hygiene 82, 930–934.

Malay, D.U., Kulkarni, U.A., Kulkarni, S.G., Kulkarni, N.D., Juju, R.B., 1986. Clinical profile of snakebite at SRTR Medical College Hospital, Ambajogai (Maharastra). Indian Medical Gazette 131, 363–366.

Nhachi, C.F., Kasilo, O.M., 1994. Snake poisoning in rural Zimbabwe. A prospective study. Journal of Applied Toxicology 14, 192–193.

Warrell, D.A., 1999. WHO/SEARO Guidelines for 'The Clinical Management of the Snakebite in Southeast Asian Region'. Southeast Asian Journal of Tropical Medicine and Public Health 30 (suppl.), 1–85.

World Health Organisation, 1987. Zoonotic disease control: baseline epidemiological study on snakebite treatment and management. Weekly Epidemiological Review 42, 319–320.