An Epidemiological Study of Snake Envenomation in a Tertiary Care Hospital of North India

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Abstract

Purpose: To study the epidemiological profile, clinical features, complications, and outcome of snake bite cases in a tertiary care teaching hospital in north India.

Materials and Methods: A prospective cohort study of snake bites was carried out from June 2012 to October 2013. Data was collected regarding the socio-demographic profile, clinical features, complications, management and the outcome. The ICU LOS and the associated mortality were taken as the measures of outcome.

Results: Out of the total 88, majority of the victims were rural men in the age group of 21-30 years. More than 90% of incidents were reported during the monsoon season. Neuroparalysis was present in 92% of patients. The mean bite to hospital time was 5.66 ± 1.78 hours. All patients had received polyvalent ASV with a mean dose of 20.85 ± 5.73 vials. 61.36% patients required ventilatory support with mean duration of 5.22 ± 7.69 days. The ICU LOS was observed to be 4.83 ± 6.96 days and associated mortality rate was 6.8%.

Conclusion: There is urgent need to create awareness amongst the vulnerable population. To get a real picture of the burden, information need to be collected from community based surveys along with the peripheral primary healthcare centers.

Key words: *Snake bite; envenomation; anti-snake venom (ASV); venomous snakes; neurotoxic; hemotoxic*

Introduction

Snake envenoming is an acute life-threatening neglected public health issue in many tropical and subtropical countries, particularly in rural regions, mainly affecting farmers, laborers, hunters, shepherds, snake rescuers, and migrant populations. About 5.4 million snake bites happen every year globally, bringing about 1.8 to 2.7 million instances of envenoming with mortality ranging between 80 thousands to 1.4 lakh deaths.[1] Most of these cases occur in Africa, Asia and Latin America. According to WHO estimates, India accounts for half the global deaths due to snake bites and as per a 2005 study around 50000 people die of snake envenoming every year in India, although this figure is probably underestimated because most patients in rural areas attend village healers and so their cases go unreported.[2]

In India, the highest number of deaths due to snake bites have been accounted in rural and tribal people, who do not have an easy and early access to health services.

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In contrast to many other serious health conditions and diseases a highly effective treatment exists in the form of antivenom. Poor healthcare infrastructure and resources in many countries where snake bites are common often impede with collection of robust statistical data on the problem. Assessing the true impact is further complicated by the fact that cases reported are often only a small proportion of the actual burden because many victims never reach primary care facilities, and are therefore unreported. This is contributed to by socio-economic and cultural factors that influence treatment seeking behavior with several victims choosing traditional practices over hospital care. Lack of availability of robust data has led to poor planning and policy making as well as difficulty in estimating the actual need of antivenoms. Whereas snake envenoming has never received the necessary and required attention in the past, its recent inclusion by the World Health Organization (WHO) into the list of "Neglected Tropical Diseases" would unleash the opportunities for better understanding and management.[3] In the context of limited data availability regarding epidemiology of snake bite in the Indian subcontinent, this study was carried out. The objectives were to study the epidemiology, clinical features, complications and outcome of snakebites in a tertiary care level teaching hospital of north India.

Materials and Methods

This prospective cohort study was conducted in the multidisciplinary Intensive care unit (ICU) of Department of Pulmonary and Critical Care Medicine at Pt. B.D.Sharma Post Graduate Institute of Medical Sciences, Rohtak (Haryana) from June 2012 to October 2013. All patients who were admitted in the Emergency department of Pt. B.D.Sharma PGIMS, Rohtak with a history of snake bite were included in the study. Informed consent was obtained and a detailed history of each patient was taken and following parameters were obtained: Sociodemographic profile of the snakebite victims, time & site of bite, circumstances/activity at the time of bite, any pre-treatment/ first aid received, duration (hours) between time of snakebite and access to the hospital, signs & symptoms, the amount of ASV received, requirement of assisted ventilatory support, development of any complications and adverse reactions to antivenom and the outcome. Outcome was measured in terms of ICU length of stay (LOS) and the associated mortality. Statistical analysis was done using SPSS software (version 20). Statistical significance was defined as P value < 0.05.

RESULTS

A total number of 88 patients were admitted with a history of Snake bite during the period between June 2012 to October 2013. Age-wise distribution of the patients is depicted in Figure 1. A majority i.e, 54.5% (48) of the victims were in the age group of 21-30 years, followed by 23.8% (21) in the age group of 31-40 years. 12.5% (11) of the patients were below 20 years of age. Table 1 shows socio-demographic profile of the snake bite cases. Out of 88 patients, 68 (77.27%) were males and 20 (22.72%) were females. More than 90% of the victims belonged to rural background. Out of the total, a majority, i.e, 63.6% (56) of the patients were laborers (including unskilled, manual laborers and farmers). It was found that 91% of the snake bite cases were clustered in the monsoon season i.e, from June to September. No case of snake bite was reported between the months of December and May. 61.4 % (54) incidents of snake bite took place during the night time whereas 38.6% (34) occurred during the day. It was observed that 46.6% of snake bites took place while the individuals were sleeping whereas 39.8% (35) incidents occurred while doing labour or agricultural work. Foot was found to be the most frequently bitten site (53.4%), followed by leg (19.3%), hand (14.8%) and arm (12.5%). Among the forms of pre-treatment received, tourniquet was tied in 41 patients, washing of the wound was done in 27 patients, sucking of wound in 14 patients and 31 patients had received some treatment from traditional healers. None of the patients had received ASV prior to hospital admission. The mean time of arrival to hospital after the incident of snake bite was 5.66 ± 1.78 hours.

Various clinical features associated with snake bite are shown in Table 2. Neuroparalytic features, characteristic of Cobra and Krait bites were observed in 92% (81). Out of these patients with neuroparalytic features, ptosis was present in all 81, whereas 55 had associated weakness of neck flexors, 33 had ophthalmoplegia, 48 had dysphagia and type II respiratory failure was present in 51 patients. Hemostatic abnormalities, hallmark of viper bites were seen in 7 (8%) patients, out of which 3 had developed MODS with AKI and ARDS requiring

mechanical ventilation. No patient had symptoms of both neuroparalysis and hemostatic dysfunction. Local reaction was seen in 12 (13.6%) patients. All 88 victims of snake bite received equine polyvalent antivenom (one reconstituted vial=10ml). The mean dose of ASV given was 20.85 ± 5.73 vials. None of the patient had developed any adverse reaction to anti-snake venom. Six out of total 88 patients died giving a mortality rate of 6.8%.

Table 3 shows the duration of mechanical ventilation, ICU LOS and dose of ASV required in patients with Snake bite.A total 54 patients required ventilatory support. Of these, 51 patients had primarily type II respiratory failure as a feature of neuroparalysis while 3 patients had hemostatic dysfunction and had developed secondary MODS with ARDS requiring mechanical ventilation. Duration of mechanical ventilation was significantly higher in non-survivor group (11 ± 10.35 days in non surviovors Vs 4.5 ± 7.11 days in survivors, p value 0.0392). Non-survivors also had significantly longer stay in the ICU (13.17 ± 9.83 days) as compared to survivor group (4.22 ± 6.36 days) with p value 0.0019. Dose of ASV used in non-survivors (26.67 ± 5.16 vials) was also observed to be significantly higher than that required for survivors (20.43 ± 5.57 vials).

Table 1. Demographic profile of patients with Snake bite

S.No	Variable	Number of patients	Percentage
1	Total number of patients with snake envenoming Male Female	88 68 20	 77.3% 22.7%
2	Rural Urban	81 07	92% 8%
3	Occupation Labourer & Farmer Housewife Others	 56 16 16	 63.6% 18.2% 18.2%
4	Time of snake bite Day Night	 34 54	 38.6% 61.4%
5	Activity at the time of snake bite Sleeping Labour work (including agricultural work) Household work Others	 41 35 07 05	 46.6% 39.8% 7.9% 5.7%
6	Site of bite Foot Leg Hand Arm	 47 17 13 11	 53.4% 19.3% 14.8% 12.5%

Table 2. Clinical Features of patients with Snake bite

S.No	Variable	All Patients (n=88)	Survivors (n=82)	Non Survivors (n=06)	p value
1.	No.of patients requiring Assisted Ventilatory Support	54	48	06	
2.	Duration of Mechanical Ventilation	5.22 ± 7.69 days	4.5 ± 7.11 days	11 ± 10.35 days	0.0392
3.	Length of stay in the ICU	4.83 ± 6.96 days	4.22 ± 6.36 days	13.17 ± 9.83 days	0.0019
4.	No. of ASV vials	20.85 ± 5.73 vials	20.43 ± 5.57 vials	26.67 ± 5.16 vials	0.0093

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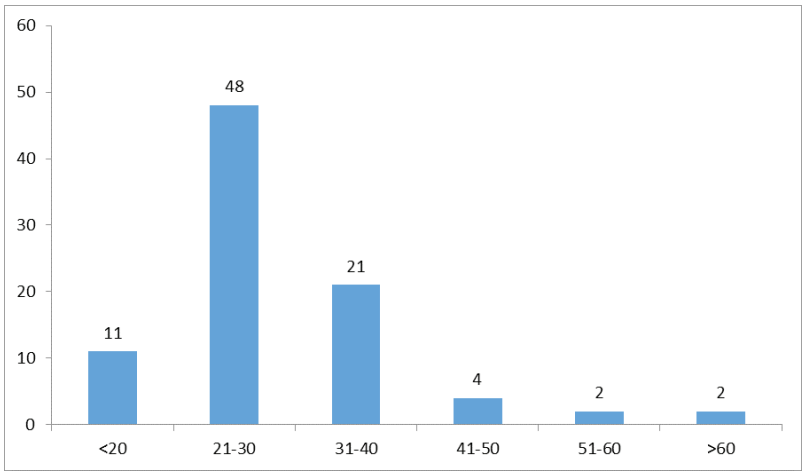

Figure 1. Age wise distribution of snake bite patients

Discussion

Venomous snake bite can lead to acute medical emergencies like severe neuroparalysis casuing acute respiratory failure, bleeding and coagulation disorders, acute kidney injury and multiorgan dysfunction. Common venomous snakes in India include the elapid family and the viper family. Snakes of family Elapidae consisting of the common krait (*Bungarus caeruleus*) and the Indian cobra (*Naja naja*) are neurotoxic, whereas those of Viperidae which includes Russell's viper (*Daboia russelii*), and saw-scaled viper (*Echis carinatus)* are hemotoxic. These four species accounts for 98% of snake bite deaths in India. Most of the cases of snake bites usually occurs in rural regions, particularly amongst laborers, farmers working in agricultural fields and those sleeping outdoors.[4,5] In the present study also, a majority of snakebite victims were unskilled manual laborers and farmers belonging to rural background. Incidents of snake bites were more frequent in males than females, probably because of the fact that males are more involved in labour work and outdoor activities than females. In accordance with the earlier studies, more snakebites occurred during night time (61.4%).[6] Of the "Big Four" species, the common krait is nocturnal whereas the other three species typically bite during daytime or early evening hours.

It was observed in our study that a higher incidence of snakebites occurred during the monsoon season from June to September. Monsoon causes flooding of the underground burrows of snakes forcing them to come out into the open, often in contact with humans. Also most of the agricultural activities takes place during monsoon season. Similar findings showing clustering of snakebites during monsoon are reported in other Indian studies.[7] The majority of the victims (72.7%) were bitten on their lower extremities. Working with barefoots in the agricultural fields predisposes to bites on the lower limbs. Also, in most of the cases, snakes are trodden upon by the victims.

Seventy six of our patients had received some form of pre-treatment before arrival to the hospital of which application of tourniquet was most common (46.6%). 35.2% of patients had consulted traditional healers before arriving to hospital. This irrational health-seeking behavior may be attributed to their low socio-economic and educational status. It also shows their high level of faith in traditional healers. Similar findings were observed in a study conducted in rural Haryana (India) where 20.25% patients sought hospital care after consulting with traditional healers.[8] The mean time of arrival to the hospital after bite was 5.66 ± 1.78 hours. This delay can be attributed to a lack of awareness of the severity of snakebite, an insistent belief in the traditional system of medicines, lack of transport facilities or inability to afford transportation and a lack of primary healthcare facilities.

Majority of snakebites in our study were neuroparalytic (92%). Ptosis was present in all patients with neuroparalysis, whereas 55 patients had associated weakness of neck flexors, 48 had dysphagia and 51 patients went into type 2 respiratory failure requiring ventilatory support. Severity of neuroparalysis and progression to respiratory failure depends on several factors such as dose and potency of venom injected, anatomic site of bite, age, health, immune status of victim and the timing of appropriate medical treatment. 8% of our patients had hemostatic dysfunction out of which three patients died because of subsequent complications and development of Acute Kidney injury and MODS.

Antivenom is the only available effective treatment to neutralize the venom. In our study, all patients received ASV and the mean dose used was 20.85 ± 5.73 vials. In the absence of any clear guidelines, the clinical dose of ASV was decided on the empirical grounds. With this dose of ASV, we were able to salvage 93.2% (82) of patients. None of the patients in this study received anticholinesterase drugs (such as neostigmine) as there is no consensus over the routine use of such drugs and also because of the fact that these drugs act only against the post-synaptic toxins and not against the toxins acting presynaptically.

61.36% (54) patients in the present study required mechanical ventilatory support of which 51 patients had severe neuroparalysis and 3 had DIC/AKI/MODS/ ARDS . The mortality rate in our study was 6.82% which is more than that from other studies across India.[6,9,10] All six patients who died were on ventilatory support. The mean duration of mechanical ventilation and length of ICU stay was significantly longer in non survivors than survivors. Also Non-survivors required a significantly

higher dose of ASV as compared to survivors. Duration of mechanical ventilation, the length of stay (LOS) and the mortality in ICU depends upon several factors such as age, nutrition status, comorbidity, severity of underlying illness at the time of admission, use of invasive devices (like endotrachial intubation, central venous catheter), development of multiorgan failure and the nosocomial infections. In our study, the non-survivors had features of severe envenomation at the time of admission and developed complications such as sepsis with multiorgan failure, ARDS and ventilator associated pneumonia which further led to a longer duration of both mechanical ventilation and the ICU LOS.

Conclusion

The observations of our study shows that major brunt of snake bite falls on the young men, particularly laborers of rural background. Majority of the cases had neuroparalytic features for which anti-snake venom and ventilatory support remains the mainstay of treatment. In developing countries like India, a large number of cases of snake bite go unreported due to the heterogeneity of medical care and traditional cultural attitudes & practices. In the present study, the hospital based snake bite cases have been documented which tends to underestimate the overall burden in the region. The hospital based study supplemented with community based surveys and information from traditional healers can provide the actual picture. Moreover, there is urgent need for provision of anti-snake venom at the level of peripheral dispensaries and primary healthcare centres so as to decrease the morbidity and mortality associated with snake bites.

Conflict of Interest: None

Source of Funding: None

Ethical Clearance: Ethical approval was obtained from Pt.B.D.Sharma PGIMS, Rohtak, Haryana.

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