Original Article

The study of clinical profile and outcome of patients with snakebite in a rural community

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Abstract

Context: Snakebite remains an underrated cause of accidental death in modern India, primarily in rural India, where people fail to reach out to modern medicine and fall victim to the handful of quacks using traditional healing methods. If promptly diagnosed and treated based on various clinical determinants like mode of presentation, time of medical intervention, recognition of the species, and analysis of a series of reliably identified bites, the treatment outcome would be more promising. We aimed to study snakebite patients' clinical profile and treatment outcome in a rural tertiary care setup. **Materials and Method:** This is a retrospective study in which the data evaluated from an epidemiological viewpoint; gender and age of the snake bite victim, time when bitten, interval between the bite and medical consultation, pattern of toxicity, and response to anti-snake venom (ASV). **Results:** Of a total of 200 patients bitten by a snake, 121 were males, with 77% adults. In nearly all cases, the type of snake was unknown; however, most of the bites were poisonous, showing one or the other type of toxicity. One hundred seventy-one patients survived the snake bite, and 29 succumbed. When Logistic regression was done with Death/discharge as the dependent variable and "Time to bite and reaching hospital, Age, Sex, number of ASV given, Ventilation needed or not, pack cell volume (PCV) numbers, Fresh Frozen Plasma (FFP) numbers, Dialysis and presence or absence of toxicity" as the independent variables, the model developed did not account for any respectable amount of variation in the outcome. The only variable found to be predicting the outcome significantly was FFP. **Conclusion:** It is often difficult to identify the type of snake, and thus polyvalent antisnake venom remains the only available treatment resource. Readily available treatment resources, timely intervention, appropriate referral, and close ICU will alleviate mortality.

Keywords: Anti-snake venom, fresh frozen plasma, haematotoxicity, neurotoxicity

Introduction

Snakebite is an acute medical emergency requiring timely intervention. Globally there are nearly 2500 species of snakes; however, not all species are venomous. Some venomous species include families: Elapidae, Hydrophidae, Crotalidae, Colubridae, and Viperidae.[1] Snakes are distributed worldwide except in the Arctic, New Zealand, and Ireland and are more prevalent in temperate and tropical countries.[2] Nonetheless, of the 236 species found in India, only 52 are poisonous.[3] An estimated 200,000 persons per year fall prey to snakebite in India, with an estimated fatality rate of 35,000–50,000 per year.[4]

World Health Organization (WHO) has considered snakebite as one of the most neglected but crucial public health issues, especially in rural areas of tropical and subtropical countries situated in Asia, Africa, Oceania, and Latin America.[5]

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South Asia is a worryingly affected region, probably due to dense populations, vast agricultural regions, a variety of venomous snake species, and deficient snake bite control programs.[6]

Snakebite remains an underrated cause of accidental death in modern India, especially in rural India. It is even more underestimated as people fail to reach out to modern medicine and fall victim to the handful of quacks using traditional healing methods.[7] Also, timely or erroneous identification of the snake species and analysis of bite marks alters the treatment and outcomes.[8] The clinical presentation of snakebite victims also varies with age, size of the patient, the snake's species, number and location of the bite, and the quantity and toxicity of the venom.[9] Based on toxicity, they are categorized as Neurotoxic, Hematotoxic, and locally toxic.

Thus if promptly diagnosed and treated based on various clinical determinants like mode of presentation, time of medical intervention, recognition of the species, and analysis of a series of reliably identified bites, the treatment outcome would be more promising. Hence, we undertook this important but neglected research area to study the clinical profile and treatment outcome of snakebite patients in rural tertiary care set up in India's western region.

Subjects and Methods

After the ethics committee approval from the institute, data was collected from the medical records, including patients admitted at our hospital with a history of snakebite from January 2010 to June 2016 date of approval 4 August 2016.

The snakebite diagnosis was established based on details in case record history, clinical examination of the presence of bite marks, and details of snake type observed by patient and or bystanders. The data collected was evaluated for gender and age of the snake bite victim, when bitten, the interval between the bite and medical consultation, a pattern of toxicity, and response to anti-nake venom. The information was gathered and recorded in case record form. The institutional protocol included a blood workup including complete blood count, electrolyte function tests, renal function tests, urine routine and micro, haematuria, bleeding and clotting time, 20-min whole blood clotting time, and chest radiograph.

After the initial clinical evaluation and informed consent, patients were given intravenous polyvalent antisnake (ASV) venom and supportive care depending upon the systems affected.

The number of ASV required per patient was recorded, and the outcome was recorded based on the need for a ventilator, blood products, and other complications.

Results

Of 200 patients bitten with a snake, 121 were males and 79 females with maximum cases seen in the age group 15 to 30, followed by 30 to 40 and 41 to 50 years. Most of the cases (77%) were in the adult age group. Of all the cases, 59% of the patients came from the general category, whereas 41% were from below the poverty line (BPL). Most of the bites (58%) are reported to have occurred in the day between 6 am to 6 pm. The majority (57%) of the cases occurred at home, whereas the next commonest place reported was in the farms (37%). In nearly all cases, the type of snake was not known; however, most of the bites were poisonous, showing one or the other type of toxicity in 179 patients (89.5%).

Details on the number of bite marks are also missing in most cases, but the commonest site reported is leg (45%) followed by hand (43%).

Most of the snakebites were observed from May to October with maximum numbers in July and August, which coincides with the territory's monsoon season. Many of the victims were farmers (n = 38). Of 200 victims, only 79 received first aid treatment before reaching out to the hospital. Of the total 200 patients who approached the hospital, 24 had been given treatment by some faith healer initially, whereas 74 had been to some other health facility before reaching our center. One hundred seventy-one patients survived the snake bite, whereas 29 succumbed [Table 1].

Various symptoms were observed in the patients from which 32% of the patients (n = 72) had complaints of vomiting, 5.5% (n = 11) had nausea, and only 3% (n = 6) had a fever. Breathing difficulties were present in 6% (n = 12) of patients.

We observed that victims with venomous snake bites developed various complications affecting different systems. The complications observed in descending order were neurotoxic (n = 118) followed by local toxicity (n = 126) and hematotoxicity (n = 32).

Of 118 patients with neurotoxic symptoms, 11 succumbed to death, whereas five succumbed to death with hematological toxicity and 14 to local toxicity [Table 2].

Only one patient needed supportive dialysis in our study, thus making renal complications almost negligible in all patients. Ventilatory support was needed in 69 patients, of which seven succumbed to death and the rest recovered.

Of patients with local toxicity, 50% (n = 100) had edema, 14% (n = 28) had bleeding and discharge from the bite site, 16% (32) had erythema, and 8.5% (n = 17) had surrounding skin induration. The local temperature at the bite site was raised in 22% of patients compared to body temperature, and only 1.5% of patients had a cold, clammy temperature at the bite site. Pigmented changes were observed in 20.5% of patients (n = 41), whereas gangrenous changes were seen in only nine% (n = 18) of patients. Only two patients had compartment syndrome, which required fasciotomy.

Regarding number of ASV vials used per person, 74.5% (n = 149) patients needed only one vial, 7.5% (n = 15) needed two vials, 17% (n = 34) required three vials and one% (n = 2) required four vials. All patients received ASV, of which 171 patients were discharged, and 29 succumbed to death [Table 3].

When Logistic regression by backward LR method was done with Death/discharge as the dependent variable and "Time between the bite and reaching the hospital, First Aid Treatment given or not, Age, Sex, Time between bite and ASV, number of ASV given, Ventilation needed or not, PCV numbers, FFP numbers, CP, Dialysis and presence or absence of toxicity" as the independent variables, the model developed did not account for any respectable amount of variation in the outcome based on the assumed important variables. The Nagelkerke R Square was only 0.20, implying that the model accounted for only 20% variation in the outcome.

After all the iterations, the only variable of all entered in the model that was found to be predicting the outcome significantly was FFP (P = 0.001, OR = 1.799 with CI (1.262,2.563)

Table 1: Distribution of characteristics and by outcome

	Survived	Dead	*P*
Age group			
0-5	8	1	0.36
6-14	20	3	
15-30	59	7	
30-40	32	7	
40-50	30	3	
>50	22	8	
Sex			
Male	68	11	0.85
Female	103	18	
Socioeconomic status			
General	100	18	0.72
BPL	71	11	
Received first aid			
Yes	64	15	0.15
No	107	14	
Went to some other center before reaching the tertiary care center			
Yes	60	14	021
No	111	15	

Table 2: Distribution of toxicity and its association with outcome

	Survived	Dead	*P*
Neuro toxicity			
Absent	64	18	0.01
Present	107	11	
Local toxicity			
Absent	59	15	0.09
Present	112	14	
Hemato toxicity			
Absent	144	24	0.78
Present	27	5	
Any toxicity			
Absent	15	6	0.09
Present	156	23	

Discussion

India has been one of the leading countries with increased mortality associated with snake bites.[10] Some studies have estimated the death toll ranging from 46,000 to 50,000 per year.[7,11]

The Greenfields of Charutar, as the area is known, makes an ideal habitat for snakes in this part of rural central Gujarat, India. The Indian snake fauna is very rich and diversified, and there is hardly any data available on common types of snakes found in central Gujarat.[12] Almost all the snake bite types were unidentified, with no evidence to guide for antivenom treatment in our study.

The most common population affected were in the age group of 15 to 40, with males being affected more than females. Similar male preponderance was observed in other studies too.[13-15] Most of the cases were reported in the monsoon season in our study, suggesting rains to be the most appropriate time for snakes to be out in open fields. Various other studies also reported similar seasonal incidences.[7,13,16,17]

However, the majority of the snake bites in our study were during the daytime from 6 am to 6 pm, which is in contrast to other studies that observed a nighttime prevalence.[16,18,19] In current study, the most affected population included farmers, which was similar to that observed in the study by DP Punde and Halesha BR *et al.*[14,20]

In the study by DP Punde, Maharashtra's rural areas indicating patterns of snakebite and its management found most frequently observed complications were respiratory paralysis, shock, bleeding diatheses, and acute renal failure.[20] Various studies have found hematotoxicity to be a more frequent complication followed by neurotoxicity.[14] Our study shows most of the complications to be local toxicity followed by neurotoxicity.

Table 3: Univariate comparison of important quantitative variables across outcome

	Discharged		Dead		*P*
	n	Mean (SD)	*n*	Mean (SD)	
Mean (SD*) Time between bite and reaching hospital	164	7.36 (26.20)	27	25.64 (66.82)	0.172
Mean (SD*) time between bite and ASV given	128	5.06 (5.85)	12	12.94 (16.58)	0.129
Mean (SD*) Number of ASV given	171	12.46 (7.49)	29	8.41 (8.32)	0.009

*Standard deviation (SD)

Local toxicity was most commonly observed in our study group. The majority showed edema and bleeding, which was also reflected in various other studies suggesting primary wound care to be of utmost importance to avoid more grievous complications like gangrene and compartment syndrome.[16,21]

It has been reported that anaphylaxis due to ASV occurs in approximately 10% or more of those who received ASV, either early (within a few hours) or late (5 days or more). We observed minor reactions like generalized itching, chills, and rigors in 10% of our patients receiving ASV, a finding similar to that reported by other studies.[14]

In most cases, the snake species was not known, so polyvalent antisnake venom was the only resource to combat the crisis with clinical signs suggesting envenomation.

Time from bite to ASV administration has been observed to be an important factor in preventing complications and predicting the outcome in various studies.[21,22] We did not observe any significant change in the patients' outcomes with respect to time of envenomation and ASV administration. This could partly be due to the locality of the hospital amid the rural population. Another factor could be the close liaison that the hospital has with the practicing primary care doctors and family physicians in the surrounding area. The hospital conducts regular training programs and interactive sessions for the family physicians to interact with hospital faculty. During these sessions, common conditions, including snakebite, are discussed. In addition, we have a local organization, Vidyanagar Nature Club, which conducts training sessions on various local animals, including snakes, for schools, colleges, and other civil society organizations. Thus, it is possible that the delay commonly seen in other areas may not be evident in our area.[23] As seen in Sri Lanka, if doctors in charge of primary care are well trained in snakebites' management, the referral to tertiary care centers decreases, and mortality rates improve.[24] Snakebite management needs to be part of the discourse among primary care doctors and family physicians in a country such as India as much of it is rural with a high incidence of deaths due to snake bites.

Studies have shown that fresh frozen plasma (FFP) reduces the venom-induced consumption coagulopathy quicker, thus aiding in the usage of a reduced number of anti-snake venom vials.[25] Some studies also conclude that FFP does not hasten recovery of coagulopathy, especially in Russell's viper bites.[26] However, in our study, FFP was the only variable that was found to be predicting the outcome significantly; thus, it is an independent variable affecting the outcome.

Limitations: In our study, in most of the cases, the species of snake were not identified. Moreover, a comparison with the usage of FFP and the number of ASV would have provided further insight into the importance of the early introduction of FFP to reduce the ASV amount.

Conclusion

Snakebite is a typically under-reported and negligent life-threatening emergency in rural areas. Many patients fall prey to various myths and never reach out to the hospitals. In our study, we observed a seasonal and occupational incidence, making farmers more vulnerable victims during the rainy season. It is often difficult to identify the type of snake, and thus polyvalent antisnake venom remains the only available treatment resource. Considering the majorly affected victims' economic conditions, the cost factor plays a significant role for such patients. Readily available treatment resources, timely intervention, appropriate referral, and close ICU will alleviate mortality as it was observed at our tertiary care hospital.

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Conflicts of interest

There are no conflicts of interest.

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