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Epidemiological Profile of Snake Bite at Tertiary Care Hospital, North India

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Abstract

This hospital based prospective study was conducted from September 2009 to September 2011.All the patients irrespective of age and sex, who reported with history of snake bite were included in the study. A total 169 snake bite patients, consisting of 116 (68.7%) male and 53 (31.3%) female [mean (SD) age 32±12 years] were admitted to the hospital during the study period, the ratio being 2.2:1. The majority of victims belonged to rural areas (67.5%) and most vulnerable occupation group was the people involved in agricultural activities (48.5%). The study population was predominately bitten outdoors (62.7%). Most of the time people could not identify the snake (52.1%) and among identified poisonous snakes Elapidae and Viperidae type were 15.4% and 13.0% respectively. The maximum cases of snakebite were recorded in the 3rd quarter of the year (67.4%) and peak incidence of snake bite was recorded in the time between 6:00 PM to 12:00 midnight (30.2%). In 69.2% of cases, the site of snake bite was lower limbs. The commonest manifestation was fright (85.2%) followed by pain at local site (57.9%). Majority of the victims were treated with ASV (81.1%) and most of them survived (92%).

Keywords: Snake; Snake bite; Epidemiology; Venom

Introduction

Snakebite is a major public health problem throughout the world especially in tropical and sub-tropical countries. Snake venom is probably the oldest known poison to mankind and has been described in oldest medical writings and myths. Since the dawn of civilization, snakes have inspired a mystic feeling of good and evil in human mind. It has appeared in various mythologies, either as demon or as a god. In Greek mythology it represented Goddess Hygeia and was worshipped along with Asclepius, the God of Health. The tradition is carried over to the modern time and the snake has found a place in the universal symbol of medical profession.

An authentic measure of the global burden of snakebite envenoming remains obscure despite several attempts to estimate it and, apart from a few countries, reliable figures on incidence, morbidity, and mortality remains elusive. Globally every year, an estimated more than 5 million people are bitten by snakes, [1,2] resulting in approximately 20,000 to 1, 25,000 deaths[3]. India has the highest number of deaths due to snake bites in the world with 35,000–50,000 people dying each year according to World Health Organization (WHO) direct estimates [3]. This is especially true in rural areas where snakebites are common but there is limited access to health care and anti venoms. Further, delay in seeking medical care or lack of knowledge among primary care physicians about the correct treatment of snakebite increases morbidity and mortality [4]. But unlike mortality from snakebite poisoning the true incidence of snakebite cannot be ascertained as large number of cases goes unnoticed, treated by local quacks, or ignored considered as bites by non-poisonous snakes.

In India, land is infested with snakes ranging from 12,000 feet altitude above sea level of the Himalayas down to Cape Comorin; however, but different areas have different species preponderance. India is inhabited by more than 60 species of venomous snakes – of which only four have been popularly known to be dangerously poisonous to man; Spectacled cobra (*Naja naja*), common krait (*Bungarus caeruleus*), saw-scaled viper (*Echis carinatus*) and Russell's viper (*Daboia russelii*) [5]. The most common poisonous snake among them is common krait [6]. Bites may be inflicted in the confines of home by peri-domestic species such as cobras (*Naja)* which may live in roof spaces or under the floor and by kraits (*Bungarus)* which enter human dwellings at night in search of their prey and may bite people walking along paths in the dark. It is difficult to ascertain the correct incidence of snake bites as large numbers of cases are not reported at health care facilities and people still believe in traditional methods as first line of treatment. It is agonizing to note that some of the cinema and television serial stories breed unscientific ideas on snakes and snakebites, and relish displaying traditional treatment to accommodate the theme of the story [7].

Clinicians since pre-historic times have witnessed the tragedy of injury, disability, and death from snake bite that has been a customary sight in many parts of Africa, Asia, and Latin America. To hundreds of people living in these regions, including some of the world's most impoverished communities, snake bite is an ever present occupational risk, an added penalization of poverty. Like malaria, dengue, tuberculosis, and parasitic diseases, the risk of snake bite is always present. Unlike many of these other public health risks, however, the burden of human suffering caused by snake bite remains unrecognized, invisible, and unheard by the global public health community, forgotten

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by development agencies and governments alike. The problem is so underrated that it was only added to WHO's list of neglected tropical diseases in April, 2009 [8].

Aims and Objectives

1. To study the epidemiology of snake bite poisoning in & around district Aligarh region including incidence among various sex and age groups, the place of incidence, time and site of bite, seasonal variation, immediate manifestation, hospital stay, treatment received and final outcome.

2. To suggest measures to prevent deaths from snakebite poisoning.

Materials and Methods

Setting and study design

This hospital based prospective study was conducted in the Department of Forensic Medicine in collaboration with the Department of Medicine and Department of Pediatrics, Jawaharlal Nehru Medical College and Hospital, Aligarh Muslim University, Aligarh from September 2009 to September 2011.All the patients irrespective of age and sex, who reported with history of snake bite were included in the study.

Data collection

The study comprised of 169 patients, who were studied, from the time of reporting to the hospital and followed up till final outcome from the hospital. Patients with history of scorpion bites, bee sting and other insect bites were carefully excluded. At the time of admission preliminary data of each case, such as age, occupation, educational status, marital status, domicile and other demographic details were entered in a Performa. Further details such as circumstances involving bite, the time and site of bite, the symptoms and signs noticed on hospital admission and the treatment instituted were recorded. In most cases, the history was elicited from the patient except when compromised severely by symptoms. In that eventuality the proxy history was given by the patient relatives; however it was later authenticated by patient on recovery.

Statistical analysis

Results were expressed as frequency percentages. A probability of $P<0.05$ was considered statistically significant. SPSS (Statistical Package for the Social Sciences) version 17, 2008 statistical software was used for evaluation. Chi-square analysis was carried out to assess the association between variables.

Ethics statement

The study was approved by "Institutional Ethics Committee" of Jawaharlal Nehru Medical College, Aligarh Muslim University. All the subjects were included after their written informed consent and parents/guardians provided consent on behalf of minors.

Results

A total n=169 snake bite patients, consisting of 116 (68.7%) male and 53 (31.3%) female [mean (SD) age 32±12 years] were admitted to the hospital during the period of study. Maximum number of cases i.e., 49 (29.0%) belonged to 30-39 years of age, and the least i.e., 3 (1.8%) belong to less than 10 years of age. The circumstances of snakebite and the demography of patients are described in Table 1.

Bulk of the population i.e., 82 (48.5%) was involved in agriculture and a significant association ($p<0.05$) was found between occupation and sex among the cases of snakebite poisoning. (Table 1) Majority of the subjects bitten were illiterate i.e. 81 (47.9%). A significant association ($p<0.05$) was established between education and sex among the cases of snakebite poisoning. (Table 1) Greater part of snake bite cases were from rural region i.e. 114 (67.5%) and mostly the bites occurred outdoors i.e. 106 (62.7%). Rural area indicates that snake envenoming affects largely the poor people depending on agriculture as source of livelihood. More than half the number of snakebite poisoning cases i.e., 114 (67.5 %) reported between July to September, the peak time occurring from 18:00 to 24:00 hours.

Most of the time people could not identify the snake i.e., 88 (52.1%), and among identified poisonous snakes Elapidae and Viperidae type constituted 26 (15.4%) and 22 (13.0%) respectively. Out of 169 cases, majority of persons i.e., 117 (69.2%) were bit in the lower limbs, among them the peak time of bite was between 18.00 to 24.00 hours. Significant association ($p<0.05$) was found between site and time of the bite Table 1.

	Male	Female	Total (%)
Total number	116	53	169
Age (mean)			32
Year			
2009	23	11	34
2010	66	30	96
2011	27	12	39
Occupation (χ^2=135.8, df=4, p<0.05)			
Agriculture	79	3	82 (48.5)
Student	15	3	18 (10.7)
Unemployed	8	0	8 (4.7)
Housewife	0	45	45 (26.6)
Others	14	2	16 (9.5)
Religion			
Muslim	11	7	18
Hindu	105	46	151
Marital status			
Married	78	46	124 (73.4)
Unmarried	38	7	45 (26.6)
Education (χ^2= 11.69; df= 3; p<0.05)			
Illiterate	46	35	81 (47.9)
Primary school	33	11	44 (26.0)
High School	31	7	38 (22.5)
Senior secondary	6	0	6 (3.6)
Domicile			
Rural	81	33	114 (67.5)
Urban	35	20	55 (32.5)
Location			
Outdoor	77	29	106 (62.7)
Indoor	39	24	63 (37.3)
Season			
Jan-Mar	10	3	13 (7.7)
April-June	24	13	37 (21.8)
July-Sept	79	35	114 (67.5)
Oct-Dec	3	2	5 (3.0)
Site of bite (χ^2=19.84; df= 9; p<0.05)			
Lower limbs	84	33	117 (69.2)
Upper limbs	26	18	44 (26.0)
Head & neck	5	2	7 (4.1)
Others	1	0	1 (0.6)
Time of bite (00:00-24:00 hr)			
00:01 - 06:00	27	15	42 (24.9)
06:01 - 12:00	21	18	39 (23.1)
12:01 - 18:00	30	7	37 (21.9)
18:01 - 24:00	38	13	51 (30.1)

Table 1: Epidemiology of snakebites.

Fright was the most common distinguished subjective symptom found in our study i.e., 85.2% (144) followed by pain at the local site i.e., 57.9 % (98). Majority of the patients i.e., 137 (81.1%) were administered anti-snake venom (ASV) and most of them i.e., 126 (74.6%) recovered without sequelae (Table 2). Patients with features suggestive of non-poisonous bites were not administered anti-snake venom (ASV). Out of 169 cases, 13 (7.7%) expired, among them the major cause of death was respiratory failure. The signs/symptoms, management, hospital stay and outcome of the patients are illustrated in Table 3.

Discussion

The present study has thrown interesting statistical facts which can be discussed under the following headings:

Agricultural activity

48.5% of snakebites occurred in agriculture industry and farming activities, [4,9-12] attributed to unshod farmers which makes them prone to the risk [4,9].

Rural area

Rural inhabitants form the biggest chunk of casualties (67.5%) attributed to the labour they are generally engaged in and this collaborates with inference drawn from other studies [4,9-13].

Sex and education

The study shows that most of the snakebite victims were male (68.6%) as compared to females (31.4%). The predominance of male victims suggests a special risk of outdoor activity. This is comparable to the studies done by other authors [4,11-14].

In the present study, about 47.9 % of study population was illiterate, as majority of people living in rural areas do not have access to education. Females as compared to males were more educationally backward and further access to higher education was limited to either sex.

Outdoor activity

62.7% of the study group victims were bitten while being outdoors forming the ratio of 1.7:1 of outdoor to indoor bites. This ratio is completely in alignment of facts deducted in similar studies done elsewhere [4,14-16].

Identification of the offending snake

Cutting across barriers of class distinction, education, income and social standing 52.1% of victims expressed inability to identify the offending snake, a fact accentuated further by unfounded superstitious belief of killing the snake and burning it to ashes immediately to avoid the female snake peeping into the dead snake's eye and registering the image of killer. Later this image helps in killing the victim(s) in retaliation [17]. This is supposed to be the hardcore superstitious belief.

TREATMENT (ASV)	OUTCOME					
	CURED		EXPIRED		TOTAL	
	No.	Percent	No.	Percent	No.	Percent
GIVEN	126	74.6	11	6.5	137	81.1
NOT GIVEN	30	17.8	2	1.2	32	18.9
TOTAL	156	92.3	13	7.7	169	100.0

Table 2: Relationship between treatment and outcome.

	No. of cases	Total (%)
Type of snake		
Non poisonous	33	19.5
Poisonous		
Elapidae	26	15.4
Viperidae	22	13.0
Unidentified	88	52.1
Interval between bite & hospital admission (hr)		
0-6	82	48.5
7-12	40	23.7
13-18	20	11.8
19-24	17	10.1
≥25	10	5.9
ICU admission		
Needed	52	30.8
Not needed	117	69.2
Duration of hospital stay (days)		
<3	43	25.4
3-7	112	66.3
≥7	14	8.3
Symptoms & Signs		
Fright	144	85.2
Pain at the local site	98	57.9
Swelling at the local site	84	49.7
Difficulty in speech	38	22.4
Difficulty in breathing	37	21.8
Ptosis	42	24.8
Altered sensorium	27	15.9
Cellulitis	18	10.6
Difficulty in swallowing	30	17.7
Vomiting	48	28.4
Abdominal pain	54	31.9
Hematuria	3	1.7
Oliguria	8	4.7
ASV		
Given	137	81.1
Not Given	32	18.9
Final Outcome		
Cured	156	92.3
Expired	13	7.7
Cause of death		
Respiratory failure	7	53.8
Septicemia	1	7.6
Shock	2	15.2
Renal failure	3	23

Table 3: Characteristics of snakebites.

On the basis of signs and symptoms this study was able to establish neurotoxic (Elapidae) bites in 15.4% and hemorrhagic (Viperidae) in 13% cases. Few victims did bring the snakes- dead and captured alive-but they were too few and far between. Study done at Safdarjung hospital, New Delhi established the cohesiveness observed in this aspect in this study [18].

Period of the year

Highest numbers of bites (67.4%) were recorded in the months of July and September, which corresponds to the monsoon season in India and such incidences could be directly related to flooding of human dwellings in rural areas. A similar conclusion has been reached in studies conducted earlier [4,9,11,12].

Body region

Lower extremities were the most observed bitten part of body (69.2%) commonly the feet, upper limb (26%), head and neck (4.1%) and least on other sites such as scrotum [17] in decreasing order. Bites on the head and trunk mostly occur when nocturnal species bite people while sleeping [19]. Lower extremity as the most common site for snake bite has been observed in similar other studies [9,11,14,19,20].

Diurnal variation

In the present study, the maximum incidence of snakebite occurred between 6:00 PM to midnight (30.2%), followed by midnight to 6:00 AM (24.9%). This is mostly because of poor visibility and accidental stepping on the snake. Similar studies conducted in other parts of country showed relatively higher incidence of snake bitten cases between 6:00 PM and midnight [9,16,21] as found in our series.

Signs and symptoms

The most common symptom reported by the victim was fright (85.2%) followed by pain at site of snake bite (57.9%). This is consistent with findings reported by other authors [22,23]. Majority of the cases were administered anti-snake venom (ASV) on admission i.e. 137 cases (81.1%) and most of them survived i.e., 74.6%.

Interval between time of bite and hospital admission

Nearly half of the victims (48.5%) were admitted to the hospital within 6 hours of snake bite. Similar observation was also made by other authors [11,18,19]. The location of hospital and the means of transportation serve as the main limiting factor apart from the usual treatment from quacks for delay in arrival at hospital.

Duration of hospital stay

The average duration of hospital stay varied from 3 to 7 days (66.3%). A parallel conclusion has been reported in studies conducted earlier [9,16].

Antisnake venom and outcome

Majority of the cases were administered anti-snake venom (ASV) on admission i.e. 137 cases (81.1%) and most of them survived i.e., 74.6%. Management must be started immediately to be effective. The mortality rate was 7.7% and the leading cause of death was respiratory failure (53.8%) followed by renal failure (23%). Mortality rates in similar other studies varied from 3-6% [4,9,14,16]. Our apparently high mortality rate may be due to the delay in arriving at the hospital after the snakebite, since most patients came from 80 to 100 km away and perhaps due to patients initially seeking treatment from traditional healers and local practitioners. External factors that are not in control of the hospitals, which increase the chances of mortality in admitted cases, include not receiving first aid, unavailability of anti-snake venom (ASV) at health centres in rural areas, no transport facilities, and lack of public awareness about the urgency of treatment.

The limitation of this study is that it is a study from one centre and a multicentre study would provide a more complete epidemiology of snake bites in North India.

Conclusion

Snakebite still remains an important cause of accidental death in modern India, and its public health importance has been systematically underestimated. It is an important occupational injury affecting plantation workers, construction laborers, and farmers working in fields. The above study clearly showed that snake bites were more common in rural areas and among people who were engaged in agricultural works. Most common occurrences were during the monsoons. The lower limbs were affected the most and majority victims were males, mostly bitten by poisonous snakes.

Avoiding snake bites specially during the peak season when agricultural works are in its full swing, by taking precautions like wearing protective foot-wears, carrying a stick, approaching debris cautiously, paying attention to ground etc are perhaps the most effective tools that may significantly bring down the incidence of snake bite. Also primary health centres should be fully equipped with facilities to give first aid measures and administer anti-snake venom if required. Dissemination of information regarding quick transport, correct first aid measures and training of primary level health workers can drastically bring down the mortality of this neglected tropical disease.

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Competing Interests

The author(s) declare that they have no competing interests.

Authors' Contributions

AA collected the data and did analysis and interpretation of literature; MH and AA drafted the manuscript. SAH, SMA, MB and MS did proof reading. MS has been involved in collecting review articles; MH, SAH, AA, SMA, and MB gave final approval of the version to be published. All authors read and approved the final manuscript.

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