An epidemiological study of snakebites from rural Haryana

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ABSTRACT

Background: Snakebite is a frequently encountered medical emergency faced mainly by rural populations. It is a significant public health problem in many parts of the world, especially in South Asian countries. Aims: This study aimed to analyze the epidemiological aspects of snakebite among human snakebite victims admitted to the emergency ward of a tertiary care teaching hospital between 2010 and 2012 in rural Haryana. Additional objectives were to study other factors that have a bearing on the outcome of snakebite. Methods: In this cross-sectional study, lists of addresses and contact numbers were prepared for all the snakebite cases admitted to the emergency ward of Maharishi Markandeswar Institute of Medical Science & Research (MMIMSR), Mullana, Haryana, between June 2010 and May 2012. The subjects eligible for the study were then interviewed to gather epidemiological information. Necessary clinical data were obtained from records. Results: The majority or 49.4% of the victims were in the age group of 31-45 years, followed by 32.91% in the age group of 16-30 years. Of the victims, 20.3% were illiterates. A majority (48.1%) of the victims were manual laborers and farmers. The foot was the most commonly (62.03%) involved part of the body. Most (48.10%) of the snakebite incidents occurred while the victims were doing agricultural work. Further, 64.56% cases were reported during the monsoon season and 41.77% victims were bitten in the bush. Among the subjects, 60.76% received first aid at the site of incident, and 20.25% of them sought hospital care after consulting the traditional healers (ozhas). Time lapsed for seeking hospital treatment was less than 4 h in 55.69% of the cases. The overwhelming majority (83.54%) of snakebite victims recovered after the treatment. Conclusion: This study highlights the need for improving community education, prompt transport of bitten patients to medical care, capacity-building of medical staff at all levels, and availability of anti-snake venom in rural health facilities to reduce snakebite deaths.

Key words: Epidemiological study, rural, snakebite

INTRODUCTION

Snakebite is a frequently encountered medical emergency faced mainly by rural populations. It is a significant public health problem in many parts of the world, especially in South Asian countries. India is the largest single contributor to the global tally of snakebite deaths, with the numbers ranging 15,000-50,000 a year.[¹] The data on the morbidity and mortality of snakebite are unreliable due to an improper reporting system, as many victims of snakebite choose village-based traditional therapists.[²]
Given the development of a positive health approach and rapid urbanization with the expansion of human colonization, a better understanding of this problem is essential for prevention and therapeutic measures, to reduce morbidity and mortality from snakebites in the country.\[^3\]\ The study of the epidemiology of snakebite is essential to provide pertinent information to the concerned authorities in order to manage snakebite appropriately. Most snakebite studies in India deal with clinical and management aspects, and there are few epidemiological studies.\[^4\]

Various factors (snake, human, and environmental) interplay before, during, and after a snakebite event, therefore snakebites can be studied in terms of an epidemiological model (agent, host, and environmental factors) and analyzed in relation to time, place, and person distribution. With this background, the present study was undertaken to analyze the epidemiological aspects of human snakebite among snakebite victims admitted to the emergency ward of a tertiary care teaching hospital between June 2010 and May 2012 in rural Haryana. The additional objectives were to study other factors that have a bearing on the outcome of snakebite, such as health-seeking behavior and treatment outcomes.

**METHODS**

The present cross-sectional survey was carried out at Maharishi Markandeshwar Institute of Medical Sciences and Research (MMIMSR), Mullana (Ambala), Haryana, India. Snakebite victims who reported to the MMIMSR emergency ward between June 2010 and May 2012 were included in the study. Permission from the Institutional Review Board was sought before the commencement of the present study. Written, informed consent was obtained in the local language from every subject before conducting each interview.

All snakebite cases were classified as medicolegal cases, whose records were kept separately in the Medical Records Department (MRD). The total number of cases registered during the above period was 96. We evaluated the records of snakebite cases, where outcomes were recorded as recovered and discharged from hospital or died while in hospital. Excluded from the study were snakebite patients who absconded or left (discharged) against medical advice (LAMA), and where records were incomplete. Of the total of 96 snakebite cases, four records were not evaluated owing to incomplete diagnosis, and seven patients were found to have LAMA. Hence, 85 records of snakebite cases were evaluated.

Lists of addresses and contact numbers were prepared for all the 85 eligible cases. They themselves (in cases of recovery) or the family members or relatives of the deceased (in cases where the patient expired) were approached by the authors, who also had experience with the grieving process and with grief counseling and who visited the households of the study subjects between February and April 2012 to conduct verbal interviews. If a telephone number was available, an advance appointment was made with an appropriate respondent. The subjects of four families could not be traced and contacted, hence they were excluded from the study. Out of the 81 with whom the authors could make contact, two did not consent to participate in the study and were excluded from the study. Seventy-nine subjects finally participated in the study.

A detailed proforma was prepared for the purpose of recording the following data as observations from the present study: Sociodemographic profiles of the snakebite victims; the pattern of snakebites; time, seasonal variations, and place of occurrence of the snakebite; trends of snakebite, site, and human activity at the time of the bite; details of the circumstances leading to the event; and postbite factors including the outcomes and other relevant epidemiological data, etc.. The clinical profile included blood profile, and other important information was obtained from the records. The collected data were coded and entered into Statistical Package for Social Sciences (SPSS) version 20 (IBM, Chicago, USA). Interpretation of the collected data was done using appropriate statistical methods to obtain percentages and proportions.

**RESULTS**

**Sociodemographic profile (person distribution) of the snakebite cases**

Out of a total of 92 snakebite cases reported to MMIMSR during the study period, 13 were excluded from the study. A majority, that is, 49.4% of the victims were in the age group of 31-45 years, followed by 32.91% in the age group of 16-30-years. Victims aged under 15 years were the least (7.91%) and victims aged 46-60 years were grouped in the category of children. Of all the victims, 58.2% were males. Most (79.7%) of the victims were Hindus. Fifty-nine subjects were married, accounting for 74.7% of the total. Regarding education, 31.6% of the victims had a primary level of education, while 20.3% were illiterates. Out of the total, a majority, that is, 48.1% of the victims were unskilled laborers, including manual laborers and farmers.

**Pattern (time, place distribution) of snakebite**

*Site and circumstances (human activity) at the time of snakebite*

On analyzing the site of snakebites, it was observed that the foot was the most commonly involved (62.03%)
part of the body, followed by the hand (24.05%). It was noticed that a majority (48.10%) of snakebite incidents took place while farming or doing agricultural work [Table 1].

**Time, season, and place of occurrence of snakebite**

In the present study, the majority (63.29%) reported that the snake had bitten during daytime. Most (64.56%) of the snakebite cases were reported in the monsoon season, that is, from June to September, followed (21.52%) by the postmonsoon season. A majority of snakebite victims were bitten in the bush (41.77%), followed by those bitten while working in the field (30.38%) [Table 2].

Out of the total, 60.76% subjects received first aid at the site of incident. Tourniquet application was the most common form (43.76%) of first aid measure received by snakebite victims, followed by washing of the site of the bite (31.26%) [Table 3]. Among the snakebite patients, 63 (79.75%) received hospital treatment directly, whereas 16 (20.25%) of them sought hospital care after consulting with the traditional healers (ozhas). (Information not given in table).

Time lapsed for seeking hospital treatment was less than 4 h in 55.69% of the cases and more than 12 h in 7.59% of the cases. Most (41.79%) patients were frightened, but no local or systemic symptoms had appeared when they reported the emergency. Out of all the patients, 24.05% presented with cellulitis, followed by 13.92% with local symptoms. The prothrombin time (PTT)/activated partial thromboplastin time (APTT) levels were found to be raised in 26.58% of the victims. The overwhelming majority (83.54%) of snakebite victims recovered after the treatment [Table 3].

**DISCUSSION**

It was observed in the present study that a majority, that is, 49.4% of the victims were in the age group of 31-45 years, followed by 32.91% in the age group of 16-30 years. Others have reported similar observations.[5,6] Bites were more frequent in males than in females, which suggests that males are more likely to be bitten than females. This difference may be attributed to the fact that males tend to be occupied in more outdoor activities compared to their female counterparts.

Not surprisingly, our study revealed that a majority (48.1%) of the victims were manual laborers and farmers. Snakebite is an important occupational injury affecting farmers and plantation workers.[7] Rural dwellings and farmers working barefoot in fields or sleeping outdoors are predisposing factors for snakebites, as reported by another author.[8]

The incidence of snakebite is seasonal and the reporting of these cases during the monsoon is the highest. Rainwater floods snake burrows and the snakes then try to take shelter near human dwellings, which increases the chances of snakes feeling threatened, startled, or provoked by human beings and biting them in defense; at the same time, frogs and toads erupt from their hibernation and are preyed on by snakes that thereby come in frequent contact with humans, and when farmers engage in intense farming activities, that also brings them frequently in contact with snakes in the bush.[9,10] On the other hand, there were almost nil cases reported in the winter months, which can be attributed to the hibernation of snakes during this period. Our

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**Table 1: Distribution of subjects according to site and circumstances (human activity) at the time of bite**

| Study variable | Number of victims (%) |
|----------------|-----------------------|
| Site of bite   |                       |
| Hand           | 19 (24.05)            |
| Arm            | 3 (3.70)              |
| Forearm        | 4 (5.06)              |
| Foot           | 49 (62.03)            |
| Leg            | 4 (5.06)              |
| Total (%)      | 79 (100)              |
| Circumstances (human activity) at the time of bite | |
| Farming/doing other agricultural work | 38 (48.10) |
| Playing        | 4 (5.06)              |
| Resting (sitting/sleeping) | 11 (13.92) |
| Working (other than agricultural) | 26 (32.92) |
| Total (%)      | 79 (100)              |

**Table 2: Distribution of subjects according to pattern of snakebites**

| Study variable | N (%) |
|----------------|-------|
| Time of bite   |       |
| Day            | 50 (63.29) |
| Night          | 29 (36.71) |
| Total          | 79 (100)   |
| Season of bite |       |
| Summer (Mar-May)| 9 (11.39) |
| Monsoon (Jun-Sep)| 51 (64.56) |
| Postmonsoon season (Oct-Dec)| 17 (21.52) |
| Winter (Jan-Feb)| 2 (2.53)  |
| Total          | 79 (100)   |
| Place of bite  |       |
| The bush      | 33 (41.77) |
| Field         | 24 (30.38) |
| Cattle shed   | 2 (2.53)   |
| Garden        | 13 (16.46) |
| Inside the house| 5 (6.33)  |
| Other         | 2 (2.53)   |
| Total         | 79 (100)   |
findings are in agreement with those from previous studies.\textsuperscript{[11,12]}

Of the snakebite victims in this study, 20.25\% sought hospital care after consulting with traditional healers (\textit{ozha}s). This clearly shows improper health-seeking behavior and a high level of faith in the traditional healers. This may be attributed to their low educational status, financial problems, and lack of awareness of the efficacy of medical treatment with antivenin. In rural areas, people still prefer to go to traditional healers because they charge less and are more easily available and accessible, and above all owing to faith in them. Another study from Burdwan district of West Bengal\textsuperscript{[13]} similarly observed that 8.46\% of victims of snakebite went to the hospital after consulting with \textit{ozha}s.

In this study, it was observed that in 60.76\% of cases, the subjects received some form of first aid at the site of incident. Tourniquet application was the most common form. Another study from Maharashtra is in cohorts with the observations of our study. Tourniquet application was seen in 40.82\% of subjects, followed by the local application of lime, chilies, herbal medicine, etc. in 30.49\% of patients. Alirol \textit{et al}. also reported in their review article that over 50\% of snakebite victims used inappropriate and harmful first aid methods.\textsuperscript{[14]}

The overall mortality rate in the present study was 16.46\%. It is a little higher than the rates observed by others.\textsuperscript{[15,16]} Mortality after snakebite depends on various factors, such as amount of venom injected, site of bite (the condition is serious if the bite is on the trunk or head, neck, and face), species and size of the snake, and the presence of bacteria in the mouth of the snake or on the skin of the victim at the time of the bite. It also depends on the health of the patient (envenomation in a child is serious and even fatal) and the speed of the treatment.\textsuperscript{[17]}

This study has several strengths. First, we have studied the interplay of various factors working before, during, and after a snakebite. In-depth analysis or a close investigation of this aspect has not been made by many experts in the field. Second, all the interviews were conducted by only the authors of the study, which established a sense of uniformity. The study has some limitations as well. First, some may argue that the results obtained may not be applicable to the general population. We agree because baseline data such as income, literacy, gender distribution, and other sociodemographic and cultural factors tend to vary in different geographical areas. Second, this kind of community-based study is always susceptible to recall bias.

### CONCLUSION

The study highlights the fact that the majority of snakebites are nonpoisonous and also the need for improving community education regarding the necessary precautions to be taken against snakebites. Ensuring receipt of first aid at the site of incident and prompt transport of bitten patients to health care facilities may reduce the number of snakebite deaths.

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