

Snakebite: Admissions at a tertiary health care centre in Maharashtra, India

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Objectives. To determine the outcome, seasonal variation, and death pattern of snakebite cases admitted at the tertiary health care centre in the last 10 years.

Methods. This was a record-based retrospective descriptive study at the Dr Shankarrao Chavan Government Medical College and Hospital in Vazirabad, a tertiary health care centre in Maharashtra, India.

Results. Out of 5 639 admitted snakebite cases, 65.24% were male. The 16 - 45-year age group accounted for 84.7% of cases; 46% were referred from other health centres, mostly from rural areas; 55.2% occurred during July to September, which

coincided with the rainy season in this region; 94.6% of the snakebite patients survived; and 5.4% died. Case fatality rates were higher for females (8.78%) and for bites by neurotoxic snakes (8.91%).

Conclusions. Snakebite is a common life-threatening emergency in the study area. Ready availability and appropriate use of antivenom, early referral when required and close monitoring of patients in the hospital will help to reduce mortality from snakebites.

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Snakes are found all over the world except in the Arctic, New Zealand and Ireland, and are more commonly distributed in temperate and tropical countries.¹ Snakes are most likely to bite human beings when they feel threatened, startled or provoked, and/or have no means of escape when cornered. Snakes are likely to approach residential areas when attracted by prey, such as mice and frogs. The Deccan plateau, with its agricultural land and hot, dry climate, provides an ideal environment for cobras, kraits and vipers.² Snakebite is generally considered to be a rural problem and has been linked with environmental and occupational conditions.³ Most houses in the rural areas of India are made of mud and have many crevices where rodents flourish. Snakes have easy ingress to such houses and often enter them in search of food. Firewood and dried cow dung, stored in or near the house, provide ready shelter for snakes and rodents.⁴

Morbidity and mortality from snakebite envenomation depends on the species of snake, since the estimated fatal dose of venom varies among species. In India, almost two-thirds of the bites are attributed to the saw-scaled viper (as high as 95% in some areas such as Jammu⁵), about a quarter to Russell's viper, and smaller proportions to cobras and kraits.⁶

Snakebite is an important and serious medical problem in many parts of India. However, reliable data for morbidity and mortality are not available since there is no proper reporting system. Moreover, many cases are not recorded in official statistics, as people seek traditional treatment methods. Most snakebite studies in India deal with clinical and management aspects, and there are few epidemiological studies.⁷ We studied the epidemiology of snakebite cases over a period of 10 years.

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Aim and objectives

We aimed to study the epidemiology of snakebite cases admitted to hospital; trends of snakebite and death from snakebite; seasonal variations; and the outcomes of snakebite cases.

Methods

In a record-based retrospective descriptive study, we evaluated snakebite cases admitted to the hospital from 1999 to 2008. Data were collected from the Medical Records Department of the Dr Shankarrao Chavan Government Medical College. Recorded information was entered in a pre-coded pro forma and included age, sex, residence, site of bite, type of snake poison, whether cases had been directly admitted to this hospital or referred from other health centres, time interval between snakebite and initiation of treatment, and the outcomes of snakebite cases. The total number of hospital admissions for different illnesses during 1999 - 2008 was 488 344. As required by the government of Maharashtra, all snakebites are classified as medico-legal cases, whose records are kept separately in the medical records department. The total number of cases registered during the above period was 5 718. We evaluated only the records of snakebite cases where outcomes were recorded as recovered and discharged from hospital, or died while in hospital. Excluded were snakebite patients who absconded or were discharged against medical advice, and where records were incomplete. Of the total of 5 718 snakebite cases, 179 records were not evaluated owing to incomplete diagnosis, and patients absconded or discharged against medical advice. Hence, 5 639 records of snakebite cases were evaluated. The statistical tests applied were percentage and chi-square test, wherever applicable.

Results

The age and sex distribution of the 5 639 cases studied is shown in Table I. Snakebite was most common (57.7%) in the age group 31 - 45 years, followed by the 16 - 30-year age group (27%), constituting a total of 84.7%. Males were more prevalent than females, the ratio being 2:1. Most snake bites (3 115 - 55.2%) were seen during July - September, which coincides

with the rainy season in this region, followed by 1 210 (21.5%) cases during October - December. Fewer cases were seen in the first and second quarters of the year – 442 (7.8%) and 872 (15.5%), respectively (Table II).

Bites occurred on a lower limb in 4 642 (82.3%) cases, and an upper limb in 747 (13.3%) cases. Less common sites were the trunk in 107 (1.9%), face 113 (2%), and other parts of the body such as the neck or buttock in 30 (0.5%) cases.

Of the 5 639 cases, 2 596 (46%) were referred from other health care centres (mostly rural), while 3 043 (54%) were admitted directly to our hospital. All the referred cases received tetanus toxoid before admission to this hospital. Some cases also received antibiotic treatment and antivenoms (AVs). The total numbers of snakebite cases per year and snakebite mortality from 1999 to 2008 are shown in Table III. The number of snakebite cases per 1 000 admissions per year remained between 8.45 and 13.31 during 1999 - 2008, and the proportional mortality rate due to snake bite remained between 1.25 and 2.86.

Table IV shows case fatality rates from snakebite by age and sex. Fatality rates were higher in subjects <15 years old (11.9%) and in the 46 - 60-year-old age group (11.8%). The fatality rate was much higher (8.8%) in females than males (3.7%).

Table I. Age and sex distribution

Age (yrs)	Male (%)	Female (%)	Total (%)
<15	245 (6.7)	168 (8.6)	413 (7.3)
16 - 30	980 (26.6)	542 (27.6)	1 522 (27.0)
31 - 45	2 142 (58.2)	1 110 (56.6)	3 252 (57.7)
46 - 60	172 (4.7)	82 (4.2)	254 (4.5)
>60	140 (3.8)	58 (3.0)	198 (3.5)
Total	3 679 (100)	1 960 (100)	5 639 (100)
	(65.2)	(34.8)	(100)

Table II. Quarterly snakebite incidence

Months	Total cases	Percentage
January - March	442	7.8
April - June	872	15.5
July - September	3 115	55.2
October - December	1 210	21.5
Total	5 639	100

χ^2 for goodness of fit=2 960, df=3, $p<0.001$.

In this study, 70.5% of cases were from rural areas and 29.5% from urban areas. Snakebite mortality was higher in cases from rural areas (6.3%) than urban areas (3.4%) (Table V).

The prognosis for snakebite cases depends on various factors in addition to their treatment, including first aid immediately after the bite, early initiation of appropriate treatment, and the type of envenomation (Table VI). In this study, 3 446 snakebite cases received first aid in the form of a tourniquet or incision over the bite, or sucking on the bite. The mortality among those who received first aid before coming to the hospital was less (3.1%) than among those who did not receive first aid (9.2%). This difference is statistically significant ($\chi^2=95.36$, df=1, $p<0.01$).

Mortality was higher (8.4%) where the time interval between the snakebite and initiation of treatment was >6 hours, while it was less (4.4%) where treatment occurred within 6 hours. These findings were statistically significant ($\chi^2=29.11$, df=1, $p<0.01$).

The type of venom could not be ascertained in 1 361 cases. Mortality from neurotoxic venom was 8.9%, and 4.2% from vasculotoxic. The difference in mortality from these venoms was statistically significant ($\chi^2=21.29$, df=1, $p<0.01$).

Discussion

In the present study, snakebite was most common (57.7%) in the 31 - 45-year age group, followed by the 16 - 30-year-old age group (27%), these groups constituting a total of 84.7% of the total. Bites were more frequent in males than females, the ratio being 2:1. Others have reported similar observations.⁸⁻¹²

The 16 - 45-year age group is most active in various outdoor occupations, involving males more than females. Hence males are most prone to snakebites, as seen in this study.

Most snakebite cases (3 115 – 55.2%) were seen in the months of July to September, which coincides with the rainy season in this region, followed by 1 210 (21.5%) cases during October to December. During the rainy season, rainwater floods their burrows and snakes then try to take shelter near human dwellings, which increases the chances of snakes feeling threatened or startled or provoked by human beings, and biting them in defence. The distribution of snakebite cases in different quarters of the year was uneven, and was statistically significant (χ^2 for goodness of fit=2960, df=3, $p<0.001$) and similar to other studies.^{7,9,13,14}

In this study, most bites (4 642 – 82.3%) were on a lower limb, and on an upper limb in 747 (13.3%) cases. When farm

Table III. Snakebites per year and mortality from snakebite 1999 - 2008

Year	No. of admissions	No. of deaths	Snakebite cases	Deaths from snakebite (%)	Snakebite cases per 1 000 admissions	Proportional mortality rate from snakebite
1999	44 904	1 703	598	38 (6.35)	13.31	2.23
2000	45 261	1 547	458	31 (6.77)	10.11	2.00
2001	44 365	1 256	588	36 (6.12)	13.25	2.86
2002	43 169	1 125	526	31 (5.89)	12.18	2.75
2003	49 742	1 447	515	26 (5.05)	10.35	1.79
2004	51 210	1 428	668	38 (5.69)	13.04	2.66
2005	50 943	1 280	588	28 (4.76)	11.54	2.18
2006	53 618	1 568	655	36 (5.50)	12.21	2.29
2007	54 056	1 398	611	28 (4.58)	11.30	2.00
2008	51 076	1 196	432	15 (3.47)	8.45	1.25
Total	488 344	13 948	5 639	307 (5.44)	11.54	2.20

Table IV. Fatality rates by age and sex

Age (years)	Male		Female		Total	
	No. of deaths	Case fatality rate	No. of deaths	Case fatality rate	No. of deaths	Case fatality rate
<15	15	6.12	34	20.24	49	11.86
16 - 30	37	3.78	46	2.95	83	5.45
31 - 45	59	2.76	67	6.04	126	3.87
46 - 60	17	9.88	13	15.85	30	11.81
>60	7	5.00	12	20.69	19	9.60
Total	135	3.67	172	8.78	307	5.44

$\chi^2=63.77$, $df=1$, $p<0.01$.

Table V. Rural and urban snakebite prevalence

Location	No. of cases (%)	Deaths	Mortality (%)
Rural	3 974 (70.47)	251	6.32
Urban	1 665 (29.53)	56	3.36
Total	5 639 (100.00)	307	5.44

$\chi^2=19.9$, $df=1$, $p<0.05$.

Table VI. Prognostic factors other than treatment and mortality rates

Factors	Total cases	Deaths from snakebite (%)	p-value
First aid			
Received	3 446	106 (3.07)	$p < 0.01$
Not received	2 193	201 (9.16)	
Interval before treatment			
<6 hours	4 162	183 (4.39)	$p < 0.01$
>6 hours	1 477	124 (8.39)	
Type of envenomation			
Neurotoxic	1 133	101 (8.91%)	$*p < 0.01$
Vasculotoxic	1 244	52 (4.18%)	
Unknown	1 361	154 (11.32%)	

*Neurotoxic v. vasculotoxic.

workers are in the fields, cutting grass, etc., their lower limbs, hands and fingers are closest to ground level. Consequently, snake bites are more common on the lower and upper extremities.⁸ 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 AV at health centres in rural areas, no transport facilities, and lack of public awareness about the urgency of treatment. Hence, during the study period, snakebite cases per 1 000 admissions per year and proportional mortality rate remained somewhat similar. Children, older people and females are more prone to die from snakebites. In our study, the case fatality rates were greater in subjects <15 years old (11.9%) and in the 46 - 60 years age group (11.8%). The case fatality rate was much higher (8.8%) in females than in males (3.7%), which is similar to another report.⁸ In India, owing to cultural attitudes, male health care is often considered more important than that for females. Probably this factor resulted in immediate treatment-seeking behaviour for males and less importance being accorded to females.

Mortality from snakebite was higher in cases from rural areas (6.3%) than in those from urban areas (3.4%). Dwelling conditions in rural areas of India are more favourable for the habitation of snakes, and most rural people are engaged in agricultural work, which leads to more snakebites and consequent mortality.

The prognosis for snakebites depends on factors besides hospital treatment: whether first aid is given immediately after the bite, early initiation of appropriate treatment, and the type of venom. In this study, mortality among those who received first aid before coming to the hospital was lower (3.1%) than among those who did not receive first aid (9.2%). First aid in the form of a firm bandage, immobilising the bitten area, and incising to draw blood was applied by many patients. Mortality was higher (8.4%) in cases where the time interval between the bite and initiation of treatment was more than 6 hours, and lower (4.4%) among those who received treatment within 6 hours. Mortality from neurotoxic snakebite was higher (8.9%) than that from vasculotoxic snakebite (4.2%).

As a tertiary health care teaching hospital, our hospital has facilities for managing snakebite cases. 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.

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