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CLINICO-EPIDEMIOLOGICAL PROFILE OF SNAKE BITES FROM A TERTIARY CARE HOSPITAL IN EAST MARATHWADA, INDIA: A RETROSPECTIVE STUDY

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ABSTRACT

Snakebite is often fatal and occupational disease, especially in rural parts of the tropical and subtropical Indian region. This retrospective study analyzed the prevalence and management of snake bites in the East Maharashtra region. Snakebite is one of the prime reasons for mortality caused due to poisoning. The objective of the current study was to investigate epidemiology, clinical and non-clinical presentation, mortality rate, and complications of anti-snake venom from tertiary care hospitals in the East Marathwada region. The retrospective study was done among patients with snakebite envenomation, admitted to the tertiary care hospital, Maharashtra for 12 months. These data were compiled on a patient information sheet and analyzed using descriptive statistics such as percentages. There were 300 cases of snakebites, 55% were found as poisonous bites, and 62% of male victims suffered from a bite. Krait bites reported a high incidence. Among the vasculotoxic bites,

russell's viper bites predominated. The mortality rate was 3%. Acute kidney injury respiratory failure and early onset of symptoms were associated with poor outcomes. Most of the victims were farmers, as farming is the main occupation in the study area. Snakebite is a rural and occupational hazard majority occurrence is among farmers and plantation workers. The majority of bite cases were recorded in the rainy season. There is a need to educate the rural population about the type of snake for effective treatment.

Keywords: Snakebite, India, Cobra, Krait, Russell's viper

INTRODUCTION

Snakes are predatory reptiles that live in hot climates around the planet **[1]**. Four venomous snakes, viz., cobra, russell's viper, saw-scaled viper, and krait, occur in Maharashtra, India **[2]**. It is common among rural residents, particularly farm workers. The peninsular plateau, with its flat agricultural terrain and hot, dry climate, is an ideal habitat for cobras, kraits, and vipers **[3]**. The majority of life-threatening bites are thought to be caused by these four species, namely cobra (*Najanaja*), Russell's viper (*Daboiarusselli*), common krait (*Bungaruscaeruleus*), and saw-scaled viper (*Echiscarinatus*) [4]. Snakebite cases are estimated to be 5.4 million worldwide each year **[5]**. As per the WHO, India has seen an estimated 1.2 million (12 lakh) snakebite deaths from 2000 to 2019, an average of 58,000 per year. South Asia is the region most afflicted by snakebite envenomation, with India accounting for half of all cases (almost 2.8 million). Neurotoxins act on the neuromuscular junction. A cobra bite primarily affects post-synaptic muscle nAChRs (nicotinic anticholinesterase receptors), resulting in reversible effects and a non-depolarizing block. While β bungarotoxins in the krait bite affect pre-synaptically by forming blockages that are resistant to anticholinesterase, resulting in respiratory failure **[6, 7]**. Phospholipase A2 release in a viperine bite acts on the coagulation cascade and inhibits the activity of platelets **[8, 9]**. The high mortality rate is due to the non-availability of anti-snake venom (ASV), delayed and inappropriate administration of ASV, and lack of standard treatment protocol for the management of snake poisoning **[10]**. Further, the lack of skilled clinicians, non-availability of ventilators, facilities for dialysis, etc. will affect the condition of patients. The exact clinical data concerning snake bite prevalence; associated clinical and non-clinical parameters were not available for the mentioned geographical area. Considering the same, we have carried out a retrospective study to gather the clinico-epidemiological profile of snake bite cases admitted at tertiary care hospitals in the East Maharashtra region.

MATERIAL AND METHOD

A retrospective study was designed to obtain the information by using the hospital administrative database, medico-legal case book (MLC), reviewing patient charts, consulting with a physician and during ward rounds, etc. The data was collected from June 2021 to May 2022. The methodology was developed using references from several databases like PubMed, Delnet, Medline, Science Direct, National Library, etc. The patient information form and required data were collected by referring to various national and international articles **[4, 6, 11, 12]**. Prior permission was obtained from the Medical officer (MO) of the District Government Hospital, Osmanabad for assessing the record room of the hospital and taking ward rounds with physicians. For systematic data collection, 300 snakebite cases were closely observed. All cases of snake bites were recorded for the collection of clinical data on a prepared case report form. Prior verbal consent was obtained from the victim in front of a physician in charge. Approval for a case study and a case report form was taken from hospital authorities before the commencement of the study (Approval No.-IEC/2021-22/Retro/ID-056). The data collection included questions about the demographic and epidemiological location of the patients; detailed information about bite incidence, signs, and symptoms; age; sex; residence; occupation, type of snake, type of poison, site of the bite, place of bite, type of bite, time and date of bite, time and date of admission, time and date of discharge; signs and symptoms during transport and after admission; the result of sensitivity test, complications. Treatment such as antibiotics, supportive therapy, antivenom, need for intubation, dialysis, etc. was obtained. A close clinical examination was carried out in each case for the classification of the type of snake bite (vasculotoxic, neurotoxic, and non-poisonous). An opinion from the treating physician was taken. This data was compiled on a patient information sheet and analysed using descriptive statistics such as percentages. Inclusion criteria are set as a patient in the age group from 3 to 80 years, subjects with a confirmed diagnosis of snake bite, and patients referred from SDH (secondary district hospital) or private hospitals. The exclusion criteria such as subject who doesn't come under the pre-defined geographical area, a male/ female below 3 years and above 80 years, a subject who arrives late (i.e. after 4 days) with a serious condition, a victim with mentally retarded condition, a victim who is occupationally snake catcher.

RESULT

It was observed that a maximum number of patients was in the age group of 21 to 30

years, with 27% (N 81) and followed by the age group of 31–40 years, with 26% (N 78) **(Figure 1 a)**. The majority of snake bite incidences were recorded in August 13.3% (N 40) and 12%(N 36) **(Figure 1b)**. The major symptoms observed were pain at the site of the bite at 18.52% (N 90), swelling at 14.81% (N 72) **(Figure 3b)**, giddiness at 12.35% (N 60), and a tingling sensation at 11.11% (N 54). A moderate number of patients experienced vomiting 8.02% (N 39), nausea 6.79% (N 33), numbness 4.32% (N 21), ptosis 4.94% (N 24) **(Figure 3f)**, and dyspnoea 4.32% (N 21) **(Figure 2a)**. In 45%(N 135) of victims' bites, the snake was not identified, whereas, among the identified snakes, common krait bites were a maximum of 29% (N 87), followed by russell's viper at 13% (N 39). An Indian cobra bite was reported by 8% (N 24), whereas 5% (N 15) reported poisoning caused by saw-scaled viper bites **(Figure 2b)**. Out of 300 victims, 45% (N 135) had non-poisonous **(Figure 3d)**, unidentified bites; 37% (N 111) had a neurotoxic bite; and 18% (N 54) had a vasculotoxic bite **(Table 1 a,b,c)**. During our study, a total of 19 patients required ventilatory support; out of which 2.7% (N 8) of patients were on ventilation for more than 24 hrs **(Table 1d)**. The maximum number of patients was 53% (N 159), admitted within 1–3 hrs. 9% (N 27) of patients were admitted after 5 hours **(Table 1e)**. Out of 300 patients, 95%(N 285) were cured completely at the time of discharge, 4% (N 12) were referred to higher centers for further management, and 3% (N 9) of the victims died **(Table 1 f,g)**.9% (N 27) of patients get hypersensitivity reactions due to the administration of ASV **(Table 1-h)**. Out of 300 patients, 48 developed complications. Respiratory failure is prominent and was reported in 43.8%(N 21) of patients, whereas secondly, 37.50% (N 18) of victims reported acute renal failure. 6.3% (N 3) of patients had a complication of necrosis **(Figure3-e)**, altered sensation, and coagulopathy **(Figure 3-c) (Table 1-i)**. The majority of patients had mild 32% (N 96) or moderate 31% (N 93) envenomation **(Table 1-j)**. 62% (N 186) of snakebites were reported on the lower extremities, while 36 % (N 108) of bites were on the upper extremities **(Table 1-k) (Figure3-a)**. Amongst the 300 patients, the number of males was 62% (N 186) and 38% (N 114) of females caught in the incidence of snake bites **(Table 2-a)**. 70% (N 210) of patients had bites outdoors **(Table 2-b)**.

According to the diurnal variation parameter, the percentage of snakebite incidence is higher during the daytime at 78% (N 234) and night at 22% (N 66) **(Table 2-c)**. The higher incidences of 45.7% (N 137) of snake bites were observed in the monsoon season (June to September) and admitted to the hospital

(Table 2-d). 36% (N 108) of patients were observed with single fang bite marks **(Figure 3-c)**, whereas 29% (N 87) of patients were reported with double fang bite marks **(Figure 3-d)**. 26% (N 78) of patients were observed with no prominent bite marks **(Table 2- e)**. Around 69% (N 207) of victims were farmers. The second most occupation of patients was plantation workers/gardeners, around 15% (N 45) had a snake bite **(Table 2- f)**. The majority of the subjects belong to a rural area of Osmanabad taluka 34% (N 102) and Tuljapur taluka 20% (N 60).

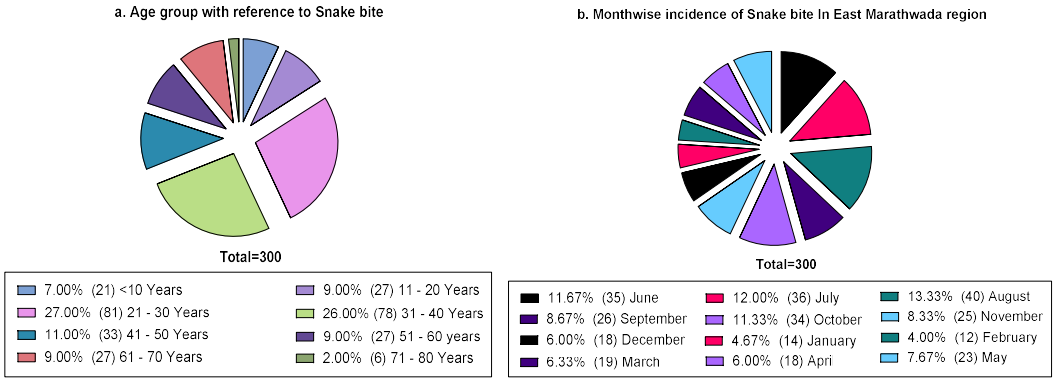

Figure 1:Pie charts of age distribution (a) and month wise- distribution (b) of snakebites

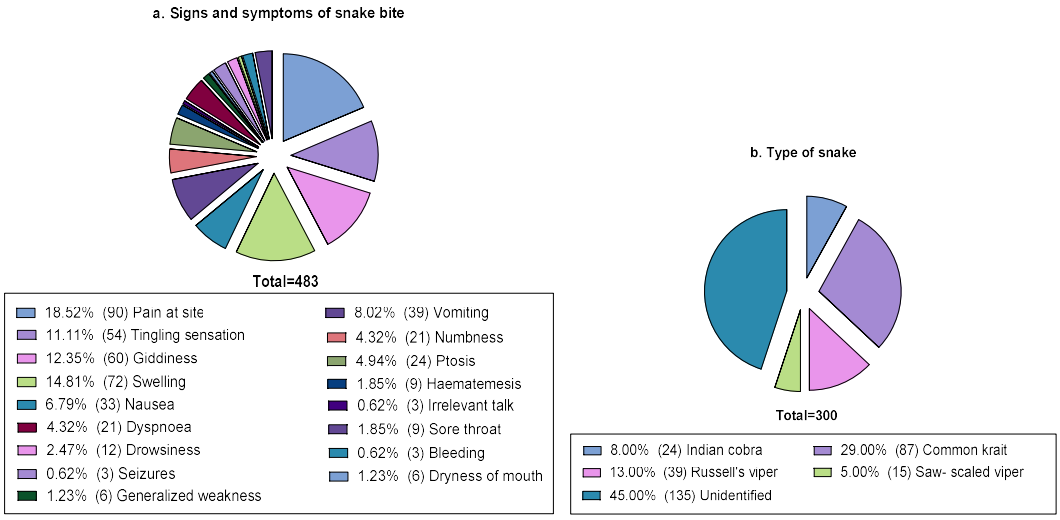

Figure 2: Pie charts of signs and symptoms (a) and types of snakes (b)

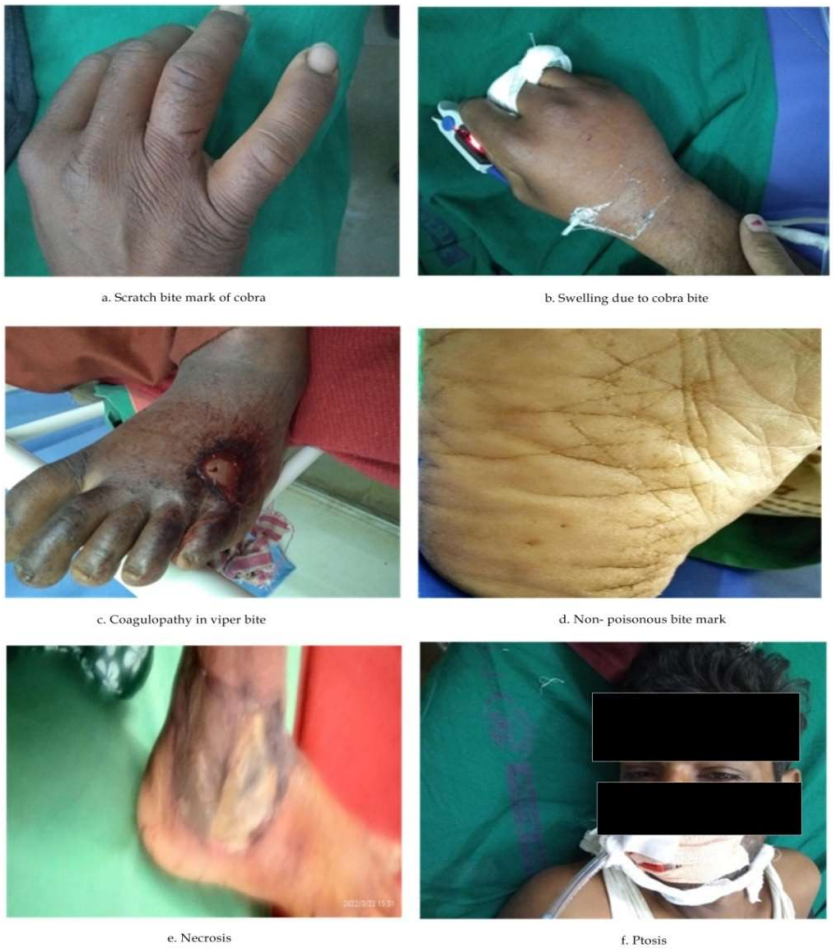

Figure 3:Bite marks and symptoms in patients.

Table 1: Clinical observations

Clinical observations	Number of patients (N)	Percentage of patients (%)
a. Type of poison		
Vasculotoxic	**54**	**18%**
Neurotoxic	**111**	**37%**
Unidentified	**135**	**45%**
b. Vasculotoxic (VT) cases		
Present	**54**	**18%**
Absent	**246**	**82%**
c. Neurotoxic (NT) cases		
Present	**111**	**37%**
Absent	**189**	**63%**
d. Assisted ventilation		
< 12 hrs.	**6**	**2%**
12–24 hrs.	**5**	**1.70%**
>24 hrs.	**8**	**2.70%**
e. Time of admission after bite		
<1hour	**66**	**22%**
1- 3 hours	**159**	**53%**
3- 5 hours	**48**	**16%**
>5 hours	**27**	**9%**
f. Discharge conditions		
Complete Recovery	**285**	**95%**
Complications/ referred to HC	**12**	**4%**
Death	**3**	**1%**

g. Comparative mortality		
Neurotoxic	6	2%
Vasculotoxic	3	1%
h. Sensitivity testing		
+ ve	27	9%
-ve	273	91%
i.Complications of snake bite		
Respiratory failure	21	43.8%
Acute renal failure	18	37.50%
Coagulopathy	3	6.3%
Altered sensations	3	6.3%
j. Severity of envenomation		
No envenomation	54	18%
Mild envenomation	96	32%
Moderate envenomation	93	31%
Severe envenomation	57	19%
k. Site of bite		
Right upper extremities	63	21%
Left upper extremities	45	15%
Right lower extremities	87	29%
Left lower extremities	99	33%
Trunk	3	1%
Face	3	1%

N=300, Data presented in a number of patients and respective percentages

Table 2: Non-clinical observations

Non-clinical observations	No. of patients (N)	Percentage of Patients (%)
a. Gender		
Male	186	62%
Female	114	38%
b. Place of bite		
Outdoor	210	70%
Indoor	90	30%
c. Diurnal variations ın snake bite		
Day	234	78%
Night	66	22%
d. Seasonal incidence		
Monsoon (June- September)	137	45.7%
Winter (October- January)	91	30.3%
Summer (February- May)	72	24%
e. Type of bite mark		
No bite mark	78	26%
Single fang	108	36%
Double fang	87	29%
Scratches	27	9%
f. Occupation of patient		
Farmer	207	69%
Plantation worker	45	15%
Labour	15	5%
Other	33	11%

N=300, Data presented in the number of patients and respective percentages

DISCUSSION

In India, an estimated 2 lakh individuals are bitten by snakes each year, with 15,000–30,000 incidents being fatal **[10]**. Out of 300 cases, male victims were 62% while female victims accounted for 38%. The male-to-female ratio is 1.6:1. These figures closely resemble the recent findings **[13, 14]**. In India, men are the main providers, working outside and sleeping in farmyards during the harvest season **[15]**. The largest number was between the age of 21 and 30

years old 27%. The 31–40 years came in second in terms of frequency 26%. During the monsoon season (June to September) the snakebite incidences were high. Females were particularly vulnerable during July, as houses with grooves in the walls and firewood provided easy cover for snakes and their prey, rodents. Males were particularly vulnerable in August, as rabbis' crops such as jowar, grams, and soybeans dominated cultivation in the study area. Snakebite incidents are higher during the day (78%) due to the majority of people working on the farm during the day, i.e. from morning (6:00 am) to evening (6:00 pm). The majority of bites (62%) were on the lower limbs because most of the victims were farmers; they were bitten by snakes while working on the farm, cutting grass, and so on. Hands and fingers came closest to ground level while working their lower limbs. People from other regions primarily attended sub-district hospitals closer to their homes. Our research found that the majority of people, 75%, arrived at the hospital within 3 hours and just 9% were admitted after 5 hours. This could be due to a lack of transportation, lack of awareness, or the fact that many people first visit a Tantrik or use ayurvedic remedies **[4, 6, 16]**. Most of the snakebites in our study were unidentifiable (45%). This may be due to a lack of knowledge about the types of snakes. Amongst identifiable species, 37% of bites were neurotoxic, followed by vasculotoxic (18%). Among all bite incidents, pain at a site (18.52%), swelling (14.81%) due to the release of cytotoxins from the venom, giddiness (12.35%), and tingling sensation (11.11%) were caused due to pressure on nerves. Ptosis (4.94%), numbness (4.32%), and generalized weakness (1.32%) are mainly caused by patients who had a bite by a neurotoxic snake as venom-bound to post-synaptic muscle nAChRs **[17]**. Toxins from krait cause painful muscle breakdown and damage to blood cells, causing muscle tremors and becoming paralyzed. Most of the night incidences also involved krait bites as they are active at night and do not see people easily in the darkness **[18]**. The krait-bungarotoxin-induced presynaptic blockage is resistant to anticholinesterase, resulting in respiratory failure. Coagulopathy (6.3%) may be developed due to important coagulation factors that are activated by the specific serine proteases in the venom as they become exhausted. Altered sensations (6.3%) may be due to venom disrupting synaptic transmission by inhibiting the release of neurotransmitters from exocytosis of synaptic vesicles at the presynaptic site. The rate of completely cured patients was 95%, while 4% of patients were referred to higher centers as they required dialysis due to acute renal failure. Around 69% of the

casualties in this study were farmers, and 15 % were plantation workers/gardeners **[15, 19]**. Farmers who labour barefoot on the farm are more likely to come into contact with snakes. Anti-snake venom sensitivity arises due to hypersensitivity reactions caused by circulating immunocomplexes and is typified by serum sickness. Preformed immunocomplexes deposit in various vascular beds and cause injury at these sites, which may result in swelling and urticaria as high levels of histamine and chemical messengers are released into the skin. We found a 9% hypersensitivity reaction due to ASV administration during our study, which has a close resemblance to the study reported by Deshpande RP., *et al*., 2013 **[20]**. In our study, most of the victims were bitten outdoors (70%), mostly in the fields during the daytime. Similar findings have been reported in other studies **[21, 22]**. The mortality rate in the East Maharashtra region is only 1% as victims come to the hospital or nearby secondary care as soon as possible to get primary treatment. Children and older people are more prone to dying from snakebites **[23]**.

CONCLUSION

Snakebite is a rural and occupational hazard. Farmers and plantation workers are more likely to be affected than others. In the eastern Maharashtra region, farming is the main occupation. There is a higher incidence of bites in males as compared to females. The majority of bite cases are recorded in the rainy season. The bite mark of krait is not seen in many patients. Ptosis was seen in many patients who had neurotoxic bites. Proper first aid treatment and immediately visiting the hospital can reduce the rate of mortality. There is a need to educate the rural population about the type of snake so that it is easy to give specific treatment. Still, accurate data about epidemiology is hard to obtain as many people follow traditional methods.

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