Epidemiology and Clinical Profile of Snakebites in Goa and Surrounding Areas

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Abstract
Background/Objectives: Clinico-epidemiological profile of snake envenomation varies in different regions; however, data from India is inadequate. This study was planned to obtain such data from Goa, to help in quick identification of envenomation, prompt treatment and help in building a national database.

Methods: In this prospective observational study all patients presenting to emergency department between April 2016 to August 2017 with history of snakebite and meeting inclusion and exclusion criteria were enrolled and analysed.

Results: 236 patients were screened, 156 were eligible. Mean age was 39.5±15.6; majority (n=122, 78.2%) were in the age group of 20-59 years; 119 (76.3%) were males. Seasonal variation was noted, highest number being in June, July and between September and December. Bites occurred commonly in housewives, students and retired personnel (n=108, 69.23%). 120 patients (76.9%) had hemotoxicity, 7 (4.5%) had neurotoxicity, 29 (18.6%) had only local reaction. Clinical features seen were seen were bleeding (n= 40, 25.6%), vomiting (n=15, 9.6%), giddiness/syncope (n=14, 9%), breathlessness (n=5, 3.2%), diplopia (n=5, 3.2%), ptosis (n=7, 4.5%), dysarthria (n=1, 0.6%), altered sensorium (n=7, 4.5%), oliguria (n=2, 1.3%) and chest pain (n=1, 0.6%). Majority (n= 117, 78.5%) received antivenom within 6 hours of bite. 31 patients (20.8%) developed reactions to antivenom, most were febrile reactions (n=12, 8.05%). Anaphylaxis occurred in 4 (2.68%) patients.

Interpretations/Conclusion: Snakebite is a common medical emergency in Goa, with distinct seasonal variation. There was no association between occupation and risk of bite. Hemotoxic and local cytotoxic features predominate in this area. Antivenom reactions though common, are usually mild.

Introduction
Snakebite is a neglected public health problem globally as well as in India.1-5 Snakebite envenoming kills between 81,000 and 1,38,000 people, and leaves up to 4,00,000 more people permanently disabled every year.6 The annual incidence of snakebites in India is estimated to be 66 to 163 cases per lakh population, with annual morbidity and mortality of 1.4 to 68 per lakh and 1.1 to 2.4 per lakh population respectively.5,6 Out of an estimated 81,000 to 1,38,000 deaths that occur worldwide due to snakebites,4,5 about 45900 deaths are reported from India alone.6 About 216 species of snakes are found in India, of which 52 species are medically significant venomous snakes.7

The only treatment for snake envenomation is anti snake venom (ASV).8 However, poor access to health services, late reporting to health care system, lack of adequate training and knowledge of doctors in rational use of anti snake venom, scarcity of antivenom and its cost delays its administration.4,5

Data on snake envenomation in India is inadequate due to various factors such as underreporting, patients seeking treatment from traditional healers, lack of access to medical facility, etc.2 Clinical profile of snake envenomation differs in various regions based on the type of snakes present in that region and composition of their venom. Knowledge of common presentations in a particular region will help in quick identification of signs of envenomation and prompt treatment apart from building a national database of clinical profile of snakebites. There is only one study from Goa published earlier on timing of antivenom administration,6 however data on epidemiological and clinical profile of snakebites from Goa was lacking. This study was therefore planned to bridge this gap.

Methods
This was a prospective observational study conducted at the Department of Medicine in a tertiary care teaching institute in the state of Goa over a period of one year and five months from April 2016 to August 2017. The study was approved by the institutional ethics committee and was conducted in accordance with the declaration of Helsinki and ICMR’s ethical guidelines for biomedical research on human participants (2006).

The hospital receives patients from the entire state of Goa (either reporting directly to the institute or referred from peripheral centers/hospitals), as well as from nearby areas of Maharashtra and Karnataka. All patients presenting to the emergency department with the history of snakebite and consenting to participate in the study were screened for the study. Written informed consent was obtained from each patient. Of these, patients meeting the inclusion criteria were enrolled in the study.

Inclusion criteria
1. Adult patients above 12 years of age
2. Evidence of envenomation, determined by
   a. History of snakebite

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b. Signs of envenomation in the form of:
   i. swelling, ecchymosis, blister formation, bleeding from bite site.
   ii. disturbances in coagulation parameters (whole blood clotting time >20 minutes) with or without systemic bleeding.
   iii. severe pain over the limb.
   iv. nausea, vomiting.
   v. neurological manifestations.
   vi. Complications such as acute kidney injury, coagulopathy/DIC, compartmental syndrome, gangrene, neuroparalysis needing ventilatory support, hypotension and shock, Acute Respiratory Distress Syndrome, sepsis, etc.

Exclusion criteria

1. Patients without signs or symptoms of envenomation, either systemic or local.
2. Those with pre-existing advanced hepatic, renal, cardiac diseases or malignancy.
3. Age below 12 years.
4. Patients who declined to give informed consent or who left the hospital against medical advice.

Detailed medical history was taken and a thorough clinical examination was performed on all patients. Patients were then subjected to laboratory investigations, which included a complete blood count, 20-minute whole blood clotting time (WBCT), bleeding time, prothrombin time/international normalised ratio (PT/INR), renal and liver function tests and an electrolyte panel.

Wherever indicated, further investigations were done such as complete coagulation profile (activated partial thromboplastin time, fibrin degradation products), chest X-ray, abdominal ultrasonography, CT scan of brain, and Echocardiography.

Patients were treated as per standard practice, in accordance with the national snakebite management protocol. Patients were observed, from the time of admission up to discharge from hospital or until the death of the patient.

Statistical Methods

Data was captured in a predetermined proforma and managed in Microsoft excel spreadsheet. Statistical analysis was carried out using Statistical software SPSS for windows, version 23.0. Data was summarized as number (%) or mean ± SD as appropriate.

Results

Baseline characteristics

For this study, 236 patients were screened, of which 80 patients were excluded due to absence of any evidence of snake envenomation (non-venomous bites).

Remaining 156 patients were eligible, hence included in the analysis. Three patients (1.92%) died of snakebite.

Baseline characteristics of the study population are summarized in Table 1. Age ranged between 13 to 80 years, majority were in the age group of 20-59 years (n=122, 78.2%). Mean age was 39.5±15.6; 119 patients (76.3%) were males, and 85 patients (54.5%) were from rural areas (Table 2, Figure 1).

Identification of type of snake

Majority of patients (n= 130, 83.3%) could not identify the snake. Amongst those who identified the snake, most bites were by Russel’s viper (n=18), remaining were cobra and krait (n= 4 each).
Pain 111 (71.2)
Swelling at the site of bite 111 (71.2)
Swelling extending more than half of the bitten limb 27 (17.3)
Lab evidence of coagulopathy* 120 (76.9)

Swelling at the site of bite 111 (71.2)
was seen in 29 patients (18.58%). Out of 120 patients who had hemotoxicity, was present in 120 patients (4.5%) while only local reaction (76.9%), neurotoxicity was seen in seven patients (4.5%), decreased urine output (n=2, 1.3%), altered sensorium (n=1, 0.6%), dysarthria (n=1, 0.6%), abdominal pain was absent. The other symptoms reported were nausea (n=3, 1.9%), diaphoresis (n=2, 1.3%), breathlessness (n=5, 3.2%), ptosis (n=7, 4.5%), giddiness (n=14, 9%), altered sensorium (n=7, 4.5%), decreased urine output (n=2, 1.3%), and chest pain (n=1, 0.6%). Three patients (1.92%) died while 12 patients (7.69%) had co-morbidity in terms of surgical release incisions. None had permanent disability or amputation. The details are provided in Table 3.

From the above, it is evident that hemotoxicity was present in 120 patients (76.9%), neurotoxicity was seen in seven patients (4.5%) while only local reaction without hemotoxicity or neurotoxicity was seen in 29 patients (18.58%). Out of 120 patients who had hemotoxicity, 82 patients (52.56%) had, in addition, evidence of local cytotoxicity, thus the total number of patients with local reaction was 111 (71.2%).

**Bleeding manifestations (Table 4)**

Forty patients (25.6%) had bleeding manifestations. Thirty one patients (19.9% of total, 77.5% of patients with hemotoxic features) presented with bleeding from the site of bite while 14 patients (9% of total, 35% of hemotoxic) presented with bleeding from sites other than the bite site. Some patients had bleeding from multiple sites.

**Treatment**

Out of 156 patients enrolled in the study, 149 patients received antisnake venom. The remaining seven patients did not have any signs of systemic envenomation, except local reaction. They were observed for development of systemic signs or worsening of local signs. They responded to local care and symptomatic treatment, hence did not receive antivenom.

Table 5 shows the distribution of patients based on total dose and initial dose of antivenom received by them.

**Duration between snakebite and start of 1st dose of antivenom venom (bite to needle time)**

Majority of patients in our study (n=117, 78.5%) received the first dose of antivenom within 6 hours of bite. Only 11 patients (7.3%) received antivenom venom later than 12 hours of bite due to late arrival at medical facility. Of these, two patients (1.3%) received antivenom venom after 24 hours.

**Reactions to anti snake venom**

Out of 149 patients who received antivenom venom, 31 patients (20.8%) developed reactions, of which, majority were febrile reactions (n=12, 8.05%). Hypotension secondary to antivenom was seen in nine patients (6.04%) while anaphylaxis occurred in four patients (2.68%). Other minor reactions were rash (n=5, 3.35%) and vomiting (n=1, 0.67%).

**Discussion**

The World Health Organization has recently declared snakebite envenomation to be a priority neglected tropical disease. It has initiated steps for developing a road map for reducing the morbidity and mortality due to snake envenomation globally. In order to achieve this goal, there is an urgent need to develop a national database regarding the clinico-epidemiological profile of snakebites.

While different studies on such profile are available from various parts of the country, data form Goa was lacking. The present study was therefore planned. This is the first paper reporting clinical profile of snakebite envenomation from Goa and neighboring areas.

A total of 236 patients presented to emergency department of our institution with history of snakebite during the study period, out of which, 156 patients had venomous snakebites. This shows that similar to other parts of the country, snakebite is a common medical problem in our state. This is because Goa is located near Western Ghats, thus many parts of Goa are closer to forests, which increases the chance of human-snake contact. The risk is further augmented by agricultural activity, as farming is a predominant activity in Goa. Persons involved in agricultural activity are at a higher risk of snakebites.

Males predominated in our study. While some of the earlier
studies have shown similar male preponderance. Others have reported equal distribution of males and females. In studies conducted in developing countries (including the present one) males predominate, as in these areas, males work outdoors where they have a higher risk of being bitten by snakes. Thus, male to female distribution depends upon the population under study. The highest number of patients in our study were in the age group of 20-59 years (n=122, 78.2%). Similar findings have been reported by many other authors such as Mukherjee, et al (21-60 yrs, 75.41%)12, Monteiro, et al (25-55 yrs, 80.6%),17 Kirte, et al (21-60 yrs, 74.9%),19 Kularatne, et al (20-50 yrs, 74.65%),21 Myo-Khin, et al (21-50, 62%),27 and Mensah, et al (15-49 yrs, 60%).28 The higher number in this age group is probably because this age group is the working population in all communities, thus, exposed to snakebites while working outdoors.

**Seasonal variation in incidence**

There was a distinct seasonal variation noted in the present study, highest number being in the months of June and July and in the period between September and December. Monsoon is active in Goa and neighboring areas during June and July, when the region experiences heavy rainfall. Such harsh climatic condition forces snakes to move out of their shelters in search of dryer areas resulting in higher incidence of bites.20 Agricultural activities also occur in these months. Similarly, during the period between September and December, people are involved in harvesting activity, again increasing the risk of bites. Such an association with agricultural activities and seasonal variations has been well documented.9,11,13,19,22,23,29

**Type of snake**

Polyvalent antivenom available in India is effective against only four species, ie. Cobra, krait, Russell’s viper and saw scaled viper. It is not useful to treat bites by other species such as sea snakes or humped nose vipers.20 Thus, it is important to find out species of culprit snake. Identification of the species also helps in management of the patient, as based on the species involved, one can anticipate and watch for neurological symptoms, hemotoxic features and respiratory depression.20

However most patients are unable to identify the snake due to lack of knowledge about its morphological characters.13,22,30 In addition, other factors such as poor visibility and darkness, tall grass or bushes, anxiety following bite, etc. may also contribute to non-identification.5,20 In our study, too, only a small number of patients (n=26, 16.7%) were able to identify the species. This underscores the importance of training the community in identification of snakes. Interestingly, out of those who identified the snake, most were Russell’s viper bites followed by cobra and krait. However, this may not be accurate as it was based on patient’s narrative only, without any objective verification. Though similar distribution is seen in studies from other parts of the country such as Goa,20,21 Konkan (Maharashtra),22,23 and Hardi area9,13,22,23,29

**Clinical features**

Clinical profile of snake envenomation differs from region to region based on the distribution of snake species in that particular region.
and the composition of snake venom.\textsuperscript{15} Local symptoms were reported more commonly from central, South and East India,\textsuperscript{12,15,16} whereas neuroparalytic symptoms were seen more commonly in Eastern and Northern India.\textsuperscript{9,12,15,16} There was a higher incidence of local cytotoxic features (such as pain and swelling at bite site) as well as hemotoxic features. Neurotoxic features were less common. Dual toxicity (hemotoxicity + neurotoxicity), reported in some studies,\textsuperscript{13,15} was not seen in the present study.

Abdominal pain is a common and an early manifestation in snake bites.\textsuperscript{11,12,15,22} It has been mostly reported from North or East India. In our study, there was no incidence of abdominal pain probably due to the fact that the incidence of krait envenomation was very less in our study. This again underscores regional variation in clinical features.

While the laboratory evidence of coagulopathy was seen in a large number of patients in our study (n=120, 76.9\%), bleeding manifestations were noted in only 40 patients (25.6\%), the rest were clinically asymptomatic. This feature is well known\textsuperscript{14} and suggests a lesser degree of vasotoxicity in such patients.

**Antisnake venom reactions**

Though reactions to antisnake venom are commonly seen\textsuperscript{10,15,17} (one in five patients in present study), majority of these are minor. Anaphylaxis is rare. Hence, this should not deter the physician from administering life saving antivenom in snakebite patients under close monitoring.

**Conclusion**

Snakebite is a common emergency in Goa, with distinct seasonal variation. There was no association between occupation and risk of bite. Hemotoxic and local cytotoxic features predominated in this area. Reactions to antivenom though common, are usually mild.

**References**

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