

Clinical Profile of Snakebite: A Cross-sectional Study In A Upazila (Subdistrict) Health Complex, Bangladesh

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Abstract:

Background: Snakebite remains a significant public health concern in many regions of Bangladesh, particularly in southern Chattogram. The Non communicable Disease Control (NCDC) program under DGHS has put tremendous efforts and motivation toward the healthcare provider at Upazilla level to treat cases of snakebite successfully. This study provides a comprehensive analysis of snakebite cases, focusing on the epidemiological patterns, clinical profiles and management observed at Lohagara Upazilla Health Complex.

Method: Through a cross-sectional study, analysis of the records of past two years of admitted patients was done which elucidates the demographic characteristics, clinical presentations, and management outcomes of snakebite envenoming in the southern Chattogram community.

Result: A total of 202 cases of snakebite were treated successfully, among which 63.9% were male (n=129) and 36.1% were female (n=73). The mean age was approximately

32 years (± 17.40) and most were in the age group of 11-20 years (52, 25.74%). 26 (13%) cases developed local envenoming by green-pit viper bite, whereas 6 (2.9%) developed systemic envenoming with neurotoxicity alone and only 1 (0.5%) had features of both neurotoxicity and local swelling. The majority of cases had a short hospital stay, with 171 (84.7%) cases discharged after one day. Maximum patients (55.5%) reached the hospital within one hour of bite. In 53.46% of cases, the species of snakes could not be identified.

Conclusion: These findings indicate the need for targeted public health interventions focusing on education and first-aid training, as well as improved pre-hospital care practices to better address snakebite incidents.

Keywords: Snakebite, Lohagara Upazilla health complex, Venomous Snakes, Envenoming.

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Introduction:

Snakebite is the single most important cause of envenoming worldwide resulting in substantial mortality in many parts of Africa, Asia, and the Americas¹. It continues to be a significant public health concern in South Asia particularly in Bangladesh². An estimated 5.4 million people worldwide are bitten by snakes each year with 1.8 to 2.7 million cases of envenoming. Around 81,410 to 1,37,880 people die each year because of snake bites, and around three times as many amputations and other permanent disabilities are caused by snakebites annually. Bites by venomous snakes can cause paralysis

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that may prevent breathing, bleeding disorders that can lead to a fatal haemorrhage, irreversible kidney failure and tissue damage that can cause permanent disability and limb amputation. Agricultural workers and children are the most affected. Children often suffer more severe effects than adults, due to their smaller body mass³. South East Asia is considered to be most vulnerable due to its high mortality and morbidity³. High population density, widespread agricultural activities, numerous venomous snake species and lack of functional snake bite control programs have credited the South Asia to be the world's most heavily affected regions⁵.

Snakebite is often an under recognized public health issue in Bangladesh⁶. The tropical environment and the geographical location of Bangladesh favour the growing of different species of snakes. As a result, about 82 different species including 12 species of sea snakes are grossly available all over Bangladesh, of them 28 species are venomous^{2,6}. The major venomous snakes in Bangladesh are common cobra, king cobra and common

krait, uncommon kraits, Russell's viper, pit viper and the sea snakes⁷. In a series of 537 total snake bite cases in Chittagong, the neurotoxic snake bite was 10%, with 51 cobra bite and 12 kraits bite⁸.

The burden of human suffering caused by snake bite remains unrecognised, invisible and so underrated that it was only added to WHO's list of neglected tropical diseases in April, 2009. Being a tropical country, snake bite is a common problem in Bangladesh. But, the magnitude of the problem is largely unknown⁹. According to a nationwide community-based epidemiological study of snakebite and its socioeconomic consequences in Bangladesh, the incidence density of snakebite in rural Bangladesh (which is substantially higher than previously estimated) is 623.4/100,000 person years with an estimated 6,041 death annually¹⁰. The mainstay of management is anti-snake venom which although effective, can cause anaphylaxis. Traditionally, snakebite cases were managed at tertiary care hospital. Only supportive treatment including tetanus prophylaxis and assurance is sufficient for non-poisonous bites at Upazilla health complex¹¹. At Upazilla health complex, the antivenom had been usually withheld despite indication for possible danger^{12,13}. The usual tendency of the rural people is to visit their nearby traditional healers after getting snakebites. They also suffer from self-induced inappropriate application of tourniquet. So, delay in diagnosis and treatment causes fatality. For the last few years, Non-Communicable Disease Control wing of Directorate General of Health Service, Bangladesh has taken robust initiative to manage such cases at Upazilla health complex. Physicians and other health care staffs are given proper training. Also, time to time supply of antivenom is ensured. With this existing scenario, Lohagara, being the southernmost Upazilla of Chattogram district plays significant role in treating snakebite cases. Lohagara, with its population exceeding 3 lacs, represents a unique setting for studying the epidemiology and clinical manifestations of snakebites. Over the last two years (2022-2023), it has witnessed and managed a notable number of snakebite cases, providing an invaluable dataset for analysis.

This research aimed to delve into the epidemiological landscape and clinical profiles of snakebite cases, distinguishing between venomous and non-venomous incidents in this region. The diversity in snake species and the varied outcomes of envenomation made this study crucial for understanding local challenges and optimizing healthcare strategies. By elucidating the patterns of snakebites in this specific geographic and demographic

context, we hope to contribute valuable insights to the broader field of snakebite management and prevention.

Methods:

This cross-sectional study was conducted in Lohagara Upazilla health complex, Chattogram, Bangladesh. All individuals who saw snakes during bite or in whom bite mark or scratch marks were present or those who developed features of envenomation, and subsequently admitted to the health complex were considered eligible for inclusion in the study.

Based on a well-structured case record form (CRF), data were collected and analyzed accordingly. Data from January 2021 to December 2023 was collected from the CRF attached to the patients' files who were admitted to the health complex, and through personal interrogation with the patients and their attendants. Among the demographic variables, age, gender and occupation were analysed. Features during the presentation and subsequent period were noted. Cases of venomous snakebites in whom antivenom was given accordingly were addressed and outcomes were recorded.

Later, descriptive data analysis was conducted using standard statistical methods where descriptive statistics such as mean, standard deviation (SD), frequency and percentages (%) were measured using IBM SPSS 27 software.

Results:

A total of 202 snakebite cases were included in the study, with 63.9% being male (n=129) and 36.1% female (n=73).

The mean age of the patients was 31.94 years (SD±17.40). Most of the patients (52, 25.74%) belonged to the age group of 11-20 years. The age group 71-80 years consist of least patients (3, 1.48%). (fig 1)

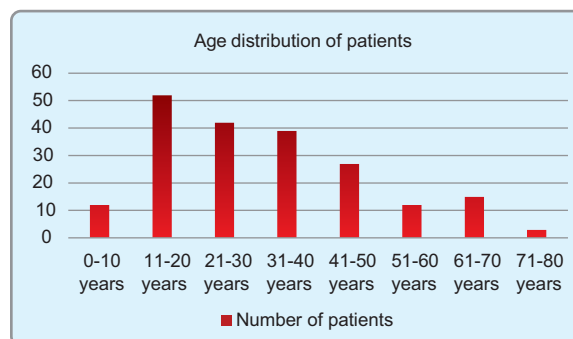


Figure 1: Distribution of patients across different age groups.

The study population was diverse, with snakebites affecting individuals in different occupations. Among them, housewives made up the highest category with 28.22% (n=57). The smallest number of victims were children (1.48%, n=3) and jobless (0.49%, n=1). Among others, there were students (23.52%, n=48), jobholders (8.41%, n=17), farmers (20.79%, n=42), labourers (1.98%, n=4), businessmen (7.92%, n=16), retired (3.96%, n=8) and drivers (2.97%, n=6). Interestingly, 5 cases involved pregnant individuals among those housekeepers.

Most snakebites (55.94%, n=113) occurred during the rainy season.

Table-I

| <i>Type of snakes identified by the victims or accompanying persons</i> | | |
|---|--------|------------|
| Types of snakes | Number | Percentage |
| Cobra | 1 | 0.5 |
| Krait | 6 | 2.98 |
| Rat Snake | 85 | 42.08 |
| Green Pit viper | 25 | 12.38 |
| Unidentified | 108 | 53.46 |

Most of the snakes were identified via description (n=90, 44.55%) from the patients and their attendants, and 4.45% (n=9) were identified by pictures taken by them. (table 1)

Table-II

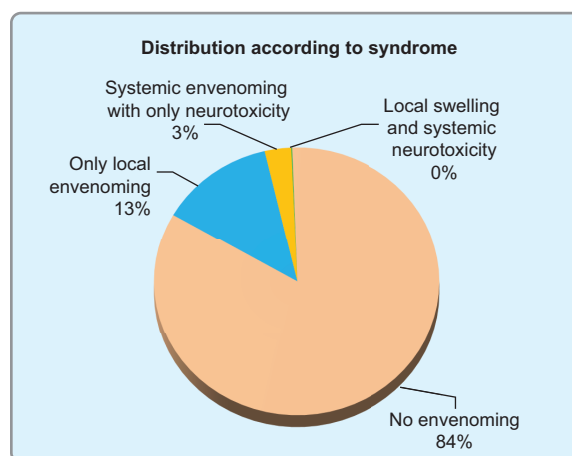
| <i>Location of Bite</i> | | |
|-------------------------|-----------------|------|
| Location of bite | Number of cases | % |
| Open ground | 17 | 8.4 |
| Mud Road | 40 | 19.8 |
| Shrub | 36 | 17.8 |
| Forest | 5 | 2.5 |
| Cultivating land | 2 | 1.0 |
| Near water | 48 | 23.8 |
| Hay stalk | 1 | 0.5 |
| Log store | 44 | 21.8 |
| At home | 9 | 4.5 |

Snakebites occurred at various locations. Most bites took place near water (23.8%, n=48) and at log store (21.8%, n=44). (table II)

Table-III

| <i>Activity of patients during bite</i> | | |
|---|--------|-------|
| Activity | Number | % |
| Asleep | 10 | 4.95 |
| Playing | 16 | 7.92 |
| Working | 107 | 52.97 |
| Walking | 69 | 34.16 |

The majority of patients (52.97%, n=107) were working during the bite, and only 4.95% (n=10) cases were asleep. (table III)

**Figure 2:** Distribution of patients according to Syndrome

Among the cases of locally envenoming with viper bites, all resulted in coagulopathy evidenced by increased whole blood clotting time (WBCT). (fig 2)

Maximum patients (n=112, 55.5%) reach hospital within one hour of bite.

Ligature was used in 48.51% cases, 4.45% cases were brought keeping the affected limb immobile and incision was given in 1% cases.

84.7% of the patients were discharged after one day at hospital, and 13.6% patients were discharged after two days at hospital. All of venomous snakebite cases received antivenom and none of them developed anaphylaxis. Also, none of them died.

Discussion:

The predominance of male patients (63.9%) in our study aligns with previous research indicating that males are more likely to be affected by snakebites due to

occupational and behavioral factors. Similar male predominance of 70.21% and 70% was also noticed in other studies in different parts of the country by Bakar et al. and Alam et al., respectively^{14,15}. However, another large-scale study by Rahman et al. reveals that snake bites are similarly distributed among males (52%) and females (female 48%) [16]. Also, in a study done by Faiz et al. at a tertiary care hospital at Chittagong, 66.41% of the cases were male¹⁷. In another study by Hasan et al. among the patients admitted at four tertiary care hospitals, 71.1% were male and the male: female ratio was 2.5:1¹⁸.

The higher incidence among the age group of 11-20 years (25.74%) in our study highlights the vulnerability of younger individuals to snakebites, possibly due to increased outdoor activities and curiosity. Higher incidence (39.36%) among young age group was also reported in similar other studies^{14,15,19}.

Our study population was diverse, with snakebites affecting individuals in different occupations. Among them, housewives made up the highest category with 28.21% (n=57) in our study. The smallest number of victims were children (1.48%, n=3) and jobless (0.49%, n=1). Similar findings were observed in a study among rural people by Rahman et al, where housewives made up the highest category of snake bite victims (30%)¹⁶. Though other studies showed least number of housewives (21.81%), rather highest number of students 58 (30.85%) among rural snakebite cases¹⁴. Another study by Hasan et al. among the patients admitted at four tertiary care hospitals, agricultural labour was the highest by occupation with 18.1%¹⁸. In a nationwide cross-sectional survey, Hossain et al. found 45.6% of the snakebite cases were children, while 29.1% were students followed by housewives (18.2%)¹⁹. In another large study among admitted patients in a tertiary hospital at Chittagong, Harris et al. showed 42% of bite victims were school/college students, 20% were housewives and 18% were day labourers/agricultural workers [20]. Interestingly, Modal found farmers were the largest number of victims followed by housewives in their study²⁵.

In our study, the peak incidence of snakebites during the rainy season (55.94%) corresponds to increased snake activity and human encounters during this time. Other studies also showed the peak month of snake

bite was June to September [14], and it is also similar to other studies in Bangladesh and other Asian countries^{16, 23, 24}.

The distribution of snake types in our study reveals a predominance of rat snakes (42.08%) and most of bites were unidentified (53.46%). This diversity poses challenges in antivenom selection and treatment. Among the identified cases of systemic envenoming kraits were 85.71% and the rest were of cobra. A significant number of cases were of Green Pit viper (12.38%) bite. Similar to our study, snakes could not be identified in 50% poisonous and 77% non-poisonous cases in a study by Miah et al. Also, among the identified poisonous snakes in their study, kraits were 84%²¹. Another hospital-based study carried out at Rangpur Medical College found that most of the venomous bites were by krait (77.78%) and cobra (22.23%)²². In our study, most of the snakes were identified via description (44.55%) from the patients and their attendants, 4.45% were identified by pictures taken by them. Interestingly, in a large study at tertiary care hospital at Chittagong, Faiz et al. showed that only 7.42 % of the victims brought the dead or living snake responsible for the bite³⁰.

The majority of bites occurring near water (23.8%) and log store (21.8%) indicate the habitats of these snakes, emphasizing the importance of preventive measures in these areas. Similar to our study, Rahman MR et al. found most of the snake bites occur in water (27%). Home premises and inside the home account for a similar proportion of bites (11% and 12% respectively)¹⁶. In our study, the majority of bites (95.5%) occurred outside the house which is similar to the finding observed in another study with 84.04% cases of snakebite occurring outside the house¹⁴. Interestingly, in a nationwide cross-sectional study by Hossain et al., the home was found the most common area for snake bite (33.6%) followed by the street (26%) and water reservoirs (25.9%)¹⁹.

In our study, majority of the patients (84.7%) got bites in their lower limbs. Among them, 41.1% bites were at their foot, reflecting the common behavior of individuals walking barefoot or in open footwear in rural areas. The leg was found to be the most common area for snake bite in other studies by Hossain J et al., Baker et al., and Mallik et al., ranging from 63.1% to 71.4%^{14,19,28}. In a large study among admitted patients at Chittagong, Harris et al. showed overall 79% of bites were on the hands or feet²⁰.

Only 4.95% of victims were found asleep in our study, while in another study by Mondal et al., 14.2% of the victims were sleeping on the floor during the time of bite²⁵. Also, in a study among admitted patients at tertiary care hospital in Chittagong, Harris et al. showed only 2% of bites involved sleeping subjects, while more than 70% of all patients were bitten on the open or scrubby ground and rural roads²⁰. Another study by Faiz et al. in Chittagong showed that 12% of patients were asleep at the time of the bite³⁰.

The fact that most patients (55.5%) in our study arrived at the hospital within one hour of the bite suggests awareness of the urgency of treatment. In a small, hospital-based study by Miah et al., mean time of interval between bite and hospitalization was 7.8 ± 9.5 hours²¹. Another study by Mondal et al. showed half of the patients brought to the hospital by less than five hours²⁵. Faiz et al. reported 6.4 hours interval until receiving treatments post-bite in Bangladesh in another study at Chittagong and Cox's bazar²⁶. Though the nearest tertiary care hospital is about 60km away from our health complex, efforts should be made to shorten this time further to reduce morbidity and mortality.

A significant proportion (21.29%) of patients in our study sought treatment from Ozha or traditional healers before reaching the hospital, which highlights the persistence of traditional beliefs and practices in the community. Only 2.47% of patients took different kinds of herbal medicine before reaching the hospital. Though in another study, 61% of causalities sought help from traditional healer or herbal medicine practitioners and only 17.4% sought medical help from Government facilities or registered doctors as a preference for first-hand treatment¹⁹. Also, in another study at tertiary care hospital by Mollik et al., herbal concoctions (of unknown origin) were given orally to 17% of envenomed victims and to 8% of those with no signs. In their study, the number was much higher (77.1%) seeking treatment from traditional healers before their admission²⁸. Another study at a tertiary care hospital in Chittagong showed that 42% of patients with signs of systemic envenoming had visited a traditional therapist²⁰. Ligature was used in 48.51% cases in our study, 4.45% cases were brought keeping the affected limb immobile and incision was given in 1% cases. In contrast to our study, Rahman MR et al. found that in 31% of snake bites the bitten parts of the body were kept immobile¹⁶. In a large study

among admitted patients at a tertiary care hospital at Chittagong, Harris et al. found constriction bandages and immobilization were used in only 2% of victims in both cases, ligatures were applied proximal to the bite site in 97–98% of cases and incisions at and around the bite site were made in 28% of envenomed victims and in 13–14% of those without signs of envenoming²⁰. In another study at Northern part of the country, Mondal et al. found almost all patients (82.1%) received ligature as a pre-hospital management, while 14.2% had incision over the bite site along with ligature and 3.8% patient received nothing. Interestingly, immobilization of the affected part was done for none of the cases in their study²⁵. Another study revealed, incisions at and around the bite site were made in 28% of envenomed victims and 13%–14% of those without signs of envenoming²⁷.

In our study, 84.7% of the patients were discharged after one day at hospital. The short hospital stay for most patients indicates that most cases were mild to moderate in severity, with prompt recovery. However, the cases requiring longer hospitalization underscore the potential complications and severity of venomous and locally venomous snakebites.

In our study, 100% of venomous snakebite cases (n=7) patients received antivenom and none of them developed anaphylaxis. Also, none of the venomous snakebite cases died. Similar findings were observed in another study among rural people by Miah MT et al., where 75% received antivenin without any occurrence of anaphylaxis²¹. Though in another study Mallik et al. showed that 74.19% developed a pyrogenic reaction who got antivenin and 48.39% developed an allergic reaction. Among the cases of allergic reaction, 16.3% had anaphylaxis²⁸. In a study among patients with neurotoxic envenomation, Amin et al. observed that 57.14% of patients developed one or many anaphylactic reactions²⁹. Out of those venomous cases in our study, 14.28% died in the emergency despite getting antivenom, rest (85.71 %) recovered within a few days at the hospital. In another study by Baker et al., 93.52% recovered completely after getting antivenin and only 6.48% died after admission¹⁴. In another study at a tertiary care hospital among venomous snakebite cases, Mollik et al. showed 60% of cases recovered completely, 17.1% recovered with complications, and 22.9% died²⁸. In a study of antivenom use in snakebite, Amin et al. showed

most of the victims delayed in attending the hospital and vital time was lost by attending to ojha and others before critical respiratory problem arises leading to death⁷.

Limitations

This study had several limitations. The hospital medical records were used for collecting data which might have resulted in incomplete or missing data. The reliance on medical records and patient recall for snake identification could introduce bias. Additionally, the study was conducted in a single health complex, limiting generalizability to the broader population. Also, only those cases of snakebites who were admitted at the Upazilla health complex were included in the study, which may not represent the actual demographic scenario of that region. Moreover, the results were only related to rural areas of the southernmost part of Bangladesh, so the situation of the whole country was not reflected.

Conclusion:

Our study on snakebite cases at Lohagara Upazilla Health Complex, Chattogram, revealed several critical insights into the epidemiology and clinical profile of snakebite victims. The majority of the victims were male, with a significant proportion of cases occurring among housewives and young individuals. Rat snakes were the most commonly identified species, though a significant number of cases could not be identified. Most snakebites occurred near water and during the rainy season. The clinically substantial majority of patients did not exhibit signs of envenoming, with local and systemic envenoming being relatively rare. Pre-hospital treatments like ligatures and herbal medicines were common with questionable efficacy. Hospital stays were typically short, and also the reduced mortality reflecting efficient management.

Recommendations:

Public health initiatives should focus on educating communities, particularly those living near water bodies and involved in outdoor activities, about snakebite prevention, identification of snakes, first-aid and early referral to hospital. Improved training for the physicians working at upazilla health complex on the management of snakebite cases, specially bedside intubation, could further improve patient outcomes and reduce mortality.

Declaration of conflicting interest

We declare no potential conflicts of interests with respect to the authorship and/or publication of this article.

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