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A retrospective study of clinico-epidemiological profile of snakebite related deaths at a Tertiary care hospital in Midnapore, West Bengal, India

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ABSTRACT

Objective: Snakebite is one of the neglected tropical diseases that World Health Organization (WHO) aimed to eradicate. The objective of the study is to investigate the mortality and morbidity due to snakebite at Midnapore Medical College & Hospital in *Paschim Medinipur* district, West Bengal, India.

Methods & materials: This is a record-based, retrospective, descriptive epidemiological study conducted from January 2012 to December 2016 at Midnapore Medical College and Hospital(MMCH), *Paschim Medinipur* district, West Bengal. The incidence and determinants of snakebite related mortality with reference to types of envenomation, age, sex, site of bite, clinical manifestations of snakebite, bite to hospital and bite to AVS treatment time, first aid and management of snakebite were investigated during the study. The data was analyzed by SPSS (Version 18) software.All results were expressed as percentage.

Results: Total number of snakebite deaths in Midnapore Medical College and Hospital(MMCH) was 222 from the period 2012–2016. Number of males was 134(60.36%) and female 88 (39.63%). Maximum snakebite deaths occurred in the age group of 31–40 years during agricultural and outdoor activities. Most of the snakebites occurred during June-September. Out of the 222 cases of snakebite, 182(82%) cases were due to viper envenomation. Maximum number of cases(n = 162) were detected in the interval between 4.00 PM to 8.00 PM. The bite to hospital time was found to be 180 ± 3.5 mins (n = 190 cases) and bite to AVS injection time was found to be 240 ± 3.5 mins (n = 190 cases). The mean bleeding time was 12.55 ± 3.2 min (n = 190 cases). The mean clotting time was found to be 20.1 ± 2.55 min (n = 190 cases). The symptoms of envenomation included local signs of inflammation(100% cases), blisters and necrosis (45% cases), renal failure (20% cases), coagulopathies(57% cases), ptosis(10% cases), dysphagia(2%) and respiratory distress(15% cases). The WHO protocol for snakebite management was followed for treatment of snakebite victims.

Conclusion: Snake bite is a neglected, life-threatening emergency in developing countries such as India and demands immediate anti-venom therapy. Hospital studies are a key source of information about snake bites. The ready availability and appropriate use of AVS, close monitoring of patients, the institution of ventilator support and if required, early referral to a larger hospital all help to reduce the mortality. Thus knowledge of the varied clinical manifestations of snake bite is important for effective management in hospitals by a complete health care team.

1. Introduction

In India, it is believed that 200,000 people are bitten by snakes and about 15,000–30,000 cases/year prove fatal [1]. Snakebite deaths are reported in India are from Bengal, Uttar Pradesh (UP), Tamil Nadu, Bihar, and Maharashtra [2]. Clinico – toxicologically, nature of snake envenomation is categorized into hemotoxic, neurotoxic, and myotoxic syndromes. Most snakebites are harmless and are caused by non-poisonous species [3]. Nonetheless, of the 3000 different species of snakes, about 450 are found to be dangerous for humans worldwide [4]. Out of 216 Indian snake species, 52 are poisonous [5]. World health organization (WHO) has recognized snakebite as neglected and important public health problem in rural areas of tropical and sub-tropical countries situated in Asia, Africa, Oceania, and Latin America [6]. According to the same WHO report, the global annual incidence of envenoming and resulting deaths ranges from a minimum of 421,000 to

Abbreviations: AVS, Antisnake venom; MMCH, Midnapore Medical College & Hospital; MSVP, Medical superintendent cum Vice Principal

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Fig. 1. Midnapore and its adjoining areas.

Table 1
Summary of species-specific severity of Indian snake envenomation based on clinico-laboratory profile.
Source: Kumar et al. [15].

Snake species	Clinico-laboratory severity grading(Grade I-IV/mild-severe)parameters
Cobra *(Naja naja)*	Local symptoms/signs of inflammation,papillary response, ophthalmic signs, cardiorespiratory and neurological manifestations
Krait(*Bungurus caeruleus)*	Pupillary response, hypokaelemia, abdominal colic, cardio-respiratory and neurological manifestations.
Saw Scaled viper(*Echis carinatus*)	Local symptoms/signs of inflammation, laboratory and clinical evidence of coagulopathy, renal failure and cardiorespiratory manifestations.
Russell's viper(*Daboia russelli)*	Local symptoms/signs of inflammation, laboratory and clinical evidence of coagulopathy, blisters and necrosis, renal failure and cardio-respiratory manifestations.

a maximum of 1,841,000 and 20,000 to 94,000, respectively. Also, it is mentioned that the highest burden of snakebites is in South Asia, Southeast Asia, and sub-Saharan Africa. Among these, India has the highest incidence of snakebite-resulted mortality, ranging from 13,000 to 50,000 cases annually [7,8]. Attributes for such a high mortality due to snakebite are scarcity of anti snake venoms (ASV), difficulties with rapid access to health centers, poor health services, and traditional treatments [9,10]. Since complications of snakebite develop rapidly and irreversibly, medical intervention must be prompt and appropriate [11]. There are various reports of herbal remedies in snakebite. Methanolic extract of *Leucas aspera* was evaluated, *in vitro*, for its ability to inhibit the major enzyme activities of *Naja naja* venom including protease, phospholipase A_2, hyaluronidase and hemolytic factors [12]. In another study, lupeol acetate from the methanolic root extract of Indian medicinal plant *Hemidesmus indicus* (L.) R.Br. (family: Asclepiadaceae) which could neutralize venom induced action of *Daboia russellii* and

Table 2
Types of envenomation in snakebite related deaths of Midnapore Medical College & Hospital(N = 222).

Types of envenomation	Number of victims(%)
Russell's viper(*Chandrabora*)	182(82%)
Common Krait	4(2%)
Naja kaouthia(*keute*)	25 (11.25%)
Missing	11(5%)

Table 3
Age-wise snakebite death distribution of Midnapore Medical College &Hospital (2012–2016).

Age (years) (N = 222)	Male	Female	Total
00 – 10	21	12	33
11–20	19	14	33
21–30	21	13	34
31–40	23	13	36
41–50	17	15	32
51–60	20	11	31
61–70	09	06	15
71–80	04	00	04
81 +	00	02	02
Age not provided	00	02	02*
Total	134	88	222

Table 4
Occupational incidence of snakebite deaths(N = 222).

Occupation	Number	Percentage(%)
Farmer	100	45
Snake charmer	40	18
Student	20	9
Housewife	35	16
Other occupations	7	3
Unavailable information	20	9

Naja kaouthia on experimental animals. Lupeol acetate could significantly neutralize lethality, haemorrhage, defibrinogenation, edema, PLA2 activity induced by Daboia russellii venom [13]. Earlier an epidemiological survey was conducted on the incidence and mortality of snakebite in 10 blocks of Paschim Midnapore district [14].

2. Methods & Materials

A hospital based, retrospective study of snakebite incidence and mortality was conducted from January 2012 to December 2016 at Midnapore Medical College and Hospital, *Paschim Medinipur* district, West Bengal (Fig. 1). A prior consent was obtained from Medical Superintendent cum Vice Principal(MSVP) of Midnapore Medical College & Hospital(MMCH) for assessing the record room of the hospital. Ethical clearance was obtained from the Institutional Ethical Clearance Committee of Midnapore Medical College & Hospital(MMCH).Both the snakebite admission and death registers within the period was reviewed thoroughly. A detailed information regarding demographic and epidemiological parameters of the snakebite victims such as age, sex, residence, occupation, site of bite and place of bite, type of snake if identified, etc., was obtained from the hospital records. Information about the victim, its management (first-aid/traditional treatment), time between bite and administration of AVS was obtained in each snakebite case registered. For identification of type of snake bite (Vasculotoxic, VT, Neuroparalytic, and Non-poisonous) opinion from treating physician was taken. Only the snakebite cases with signs of envenomation were included for the study. Non-poisonous snakebites and poisonous snakebite cases without envenomation were excluded. The catchment population included Midnapore Sadar and its adjoining areas. Midnapore Medical College & Hospital(MMCH) is the referral hospital in *Paschim Medinipur* for Midnapore and adjoining blocks. All data were analyzed using the Statistical Package for Social Sciences SPSS version 18.0(SPSS Inc, Chicago, USA). The severity of snakebite was assessed according to Table 1.

3. Results

3.1. Clinical symptoms & mortality due to snakebite

Total number of snakebite deaths in Midnapore Medical College and Hospital(MMCH) was 222 from the period 2012–2016.The case fatality rate was 3.5%. The number of snakebite cases that attended the hospital during this period was 6343 (Table 2). Number of males was 134 (60.36%) and female 88 (39.63%). Maximum snakebite deaths occurred in the age group of 31–40 years (Table 3) during agricultural and outdoor activities (Table 4). Most of the snakebites occurred during June–September (n = 182 cases). Out of the 222 cases of snakebite 182 (82%) cases were due to viper envenomation (Table 2). Maximum number of cases(72%;n = 162) were detected in the interval between 4:00 PMto 8:00 PM The bite to hospital time was found to be 180 ± 3.5 mins(n = 190 cases) and bite to ASV injection time was found to be 240 ± 3.5 mins (n = 190 cases). The mean bleeding time was 12.55 ± 3.2 min (n = 190 cases). The mean clotting time was found to be 20.1 ± 2.55 min (n = 190 cases). Most of the cases reported bites in the lower extremities(71%;158 cases) followed by upper limb and chest (29%, 64 cases).

The symptoms of envenomation included local signs of inflammation (100% cases), blisters and necrosis (45% cases), renal failure (20% cases), coagulopathies (57% cases), ptosis(10% cases), dysphagia (2%) and respiratory distress (15% cases). The complications associated with haemotoxic bite were systemic complications, acute kidney failure (20% cases) and haemolytic anemia (5% cases). Local complications included cellulitis and gangrene (33% cases) and compartment syndrome (0.5% cases). The clinical symptoms associated neurotoxic envenomation included ptosis (10% cases), dysphagia (2% cases) and cranial nerve palsy (1%cases). Autonomic disturbances resulting in resting tachycardia, labile hypertension and sweating were described in common krait envenomation.

All patients were treated with Polyvalent Haffkine® anti-snake venom, manufactured by Haffkine Bio-Pharmaceuticals Company (India) as is Snake Antivenin I® (lyophilized polyvalent enzyme refined equine immunoglobulin). Serum obtained from the plasma contains purified,enzyme-refined and concentrated specific heterologous immunoglobulins. 1 ml of reconstituted serum neutralizes 0.6 mg of Indian Cobra (*Naja naja*) venom, 0.45 mg of Common Krait (*Bungarus caeruleus*) venom, 0.6 mg of Russell's Viper (Vipera russelli) venom, 0.45 mg of Saw scaled Viper (Echis carinatus) venom. The 20 min whole blood clotting time (WBCT20) was used in case of haemotoxic bites. In case of unclotted blood 10 vials of antivenom (AVS) was administered. WBCT20 was repeated every 6 h until two consecutive (WBCT20) were clotted. Maximum prescribed AVS for haemotoxic bite was 13 vials. Dialysis was provided in 26(12% cases) [16].

For management of neurotoxic envenomation maximum 20 vials of AVS was given. 1 ampule of neostigmine was prescribed in 22 (10% cases). Ten vials of polyvalent antivenom and three doses of 2.5 mg neostigmine at 30 min intervals after administration of atropine (12–16 vial/24 h) were administered *i.v.* and patients were assessed for any improvement in neuroparalysis. There is no report of ventilatory support being given in neurotoxic bite during the study period although there was provision for it.

3.2. Reactions to AVS treatment and other medications

The symptoms associated after AVS administration were early anaphylacticreactions (15% cases) and pyrogenic reactions (20%

cases). The anaphylactic and pyrogenic reactions are due to administration of polyvalent AVS.A preparation of trypsin-chymostrysin were given in 10% cases to overcome the inflammation after envenomation. Concomitant medications prescribed were Paracetamol (fever), Diclofenac(inflammation), Tramadol(Pain reliever), Metoclopramide (nausea), Ondansetron(nausea nad vomiting), Cetrizine (relieve allergy), Deriphylline(chest tightness and shortness of breath), Ranitidine (ulcers and stomach acid), Omeprazole(gastrointestinal bleeding), Pantoprazole(swallowing difficulty), Rabeprazole(stomach problems), Glycerine Magnesium sulphate(oedema dressing), B complex. 1 ampule of adrenaline(1:1000) is injected intravenously or subcutaneously and hydroxycortisone(15 or 100 mg) is given intravenously before AVS administration. The mean duration of hospital stay of the survivors and non-survivors(n = 190) of snakebite were 7 ± 2.5 days and 3.5 ± 0.5 days respectively.

4. Discussion

In hospital-based studies, mortality rates ranged from 3%to 20% [17–19]. The various predictors of mortality are prolonged bite to hospital time [20], respiratory failure [21], and presence of severe coagulopathy [22]. The snakebite death reported from Midnapore Medical College & Hospital (MMCH) during the period January 2012-December 2016 is 222. The male to female ratio of snakebite deaths reported during the period 2012–2016 is 1.5:1. Earlier Bhatet al. [23] in 1974 reported the incidence as 7:3 (M: F). Case fatality rate in the present study was observed as which is much lower than that reported in other studies conducted in other parts of India [24,25]. Maximum number of cases were detected in the interval between 4:00 PMto 8:00 PMwhen people are engaged in outdoor activities. These figures show close resemblance with the observation of Virmani and Dutt [26]. In the present study higher incidence of snakebite was found during June-September. Earlier Banerjee [27] noted incidence of 70–80% during May to October [27]. The probable cause for this high incidence rate during June-September is that people in Midnapore are engaged in agricultural practices and the maximum snakebite occurs in the rainy months.

In the present study the mean bleeding time was 12.55 ± 3.2 min (n = 190 cases). The mean clotting time was found to be 20.1 ± 2.55 min(n = 190 cases).Snake venom contains various procoagulant factors which cause activation of coagulation cascade leading to intravascular coagulation and consumption of various clotting factors and platelets. Thus, thrombocytopenia and hemostatic abnormalities which ultimately result will cause spontaneous bleeding. The presence of spontaneous bleeding is indicative of presence of unneutralized snake venom present in circulation.

According to WHO guidelines, recommended first-aid methods for snakebite are reassurance, immobilisation of the bitten limb and movement of the patient to a place where they can receive medical care as soon as possible. Pressure immobilisation technique (PIT) which is recommended by WHO [28] was used in one of our patient in our study.

In the present study maximum 13 vials of AVS was given in viper bites and 20 vials for neurotoxic bites. Poor outcome of antivenom treatment is associated with delayed initiation of treatment, associated complications rather than total dose of ASV. Sharma et al. [29] found that the average dose of antivenom was 51.2 vials (512 cc) for elapid bites and 31 vials (310 cc) for viper bites. Punde et al. [30] found that dose of ASV required in treating neurotoxic envenomation was 40–320 ml and for viper bites it was 20–250 ml.

5. Conclusion

Snakebite is a medical emergency in developing and tropical countries. Persistent efforts thus have been made to make it a notifiable disease in the South East Asian Region (SEAR) of the WHO [31]. Surveillance of envenomations is essential for establishing guidelines, planning therapeutic supplies, and training medical staff on snakebite treatment. There is an urgent need for case documentation and reporting of the snakebite incidence and determinants in *Paschim Midnapore* district, West Bengal. In the present study we have attempted to report the hospital based official snakebite statistics (2012–2016) from Midnapore Medical College and Hospital(MMCH) which is the prime hospital of this district. Underreporting of snake bite occurrences have contributed to the variations in observed incidence. But, considering the heterogeneity of medical care and reporting and traditional cultural attitudes to snakes and snake bites, it seems likely that snake bite in Midnapore is widely underreported.

Conflict of interest

None.

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