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Research Article

Characteristics of snake envenomation in eastern India, a study of epidemiology, complications and interventions

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ABSTRACT

Background: Snake bite is an important public health problem in the tropics. The annual mortality rate in India is 15000-20000 due to snake envenomation. This study intended to analyze the characteristics of snake envenomation in detail in current time.
Methods: Total 122 cases of snake bite with features of envenomation who were admitted in our hospital in last 2 years were evaluated with detailed analysis.
Results: Significant association ($p<0.05$) ($p=0.0029$ at the degree of freedom 1) was found between time of AVS administration and development of ARF and/or RP. Patients receiving AVS at or after 6 hours were more likely to develop acute renal failure (ARF) and respiratory paralysis (RP) compared to patients receiving AVS before 6 hours.
Conclusions: Timely detection and early intervention by AVS can prevent dangerous complications and mortality of snake bites.

Keywords: Snake bite, AVS (Anti venom serum), ARF (Acute renal failure), RP (Respiratory paralysis)

INTRODUCTION

Snake envenomation is known to man since antiquity and reference to snake bites are found even in oldest medical literature. It causes significant morbidity and mortality in tropical country like India. The annual mortality rate in India is 15000-20000 due to snake envenomation.[1,2] The high mortality in India is due to climatic factors, rural predominance of population & their agricultural dependence. Nearly 3500 species of snakes exist in the world. India has about 216 varieties of snakes of which about 54 are venomous & of these only 4 varieties of snakes are commonly encountered as the cause of snake bite poisoning.[3] They are Russell's viper, Echis carinatus (Viperidae), Cobras (Elapidae) and Pit vipers (Crotalidae).[4] Most of the human snake bites occur during the monsoon season because of flooding of the habitat of snakes and their prey.[5] The families of venomous snakes are Elapidae, Hydrophidae, Viperidae and Colubridae. The major families in the Indian sub-continent are: a) Elapidae which includes common cobra, King cobra and Krait. b) Viperidae which includes Russell's viper, Pit viper and saw scaled viper and c) Hydrophiidae (sea snakes). Viperida group causes haemorrhagic syndromes. Elapidae group cause neuromuscular paralysis leading to flaccid paralysis and death by respiratory failure. The principal effects of envenomation are on the nervous system, kidney heart, blood coagulability, vascular endothelium and locally at the site of bite.[6-8] Treatment of snake bite is the care of the bitten site and anti-venom. In the treatment of bitten site, tourniquet, incision and drainage are not currently recommended in treatment of envenomation.[9,10] Early administration of anti-venom is a vital therapeutic measure. Timely administration of anti-venom completely reverses all clinical manifestations of systemic envenomation. Although the dose of anti-venom is not yet fixed but the indications are well known.[11] The anti-venom may cause severe adverse reactions.

Therefore a detailed clinical study correlating the development of complications with timing of AVS administration was needed. The present study was undertaken to study the sociodemographic characteristics, clinical profile of venomous snake bite and use of AVS as an early intervention and to study the relationship of late administration of AVS due to late arrival of patient to hospital with subsequent development of complications.

Aims and objectives

To evaluate venomous snake bite victims in order:

1) To find out socio-demographic characteristics of venomous snake bite.

2) To observe whether the study subjects received AVS prior to admission in our institute.

3) To describe the clinical profile of the study subjects.

4) To assess treatment outcome of those patients.

METHODS

Study design: Observational descriptive study of longitudinal design.

Study period: 24 months (1st June, 2012 to 31st May, 2014).

Study population: Total 122 patients.

Inclusion criteria: All suspected snake bite patients with features of envenomation admitted.

Exclusion criteria: a) Patients with clinical and/or laboratory evidence of pre-existing chronic kidney disease. b) Patients with clinical and/or laboratory evidence of pre-existing chronic lung disease.

Sample size: All suspected snake bite patients with features of envenomation admitted in Medicine in our Hospital from 1st June, 2012 to 31st May 2014 were taken for study.

Study technique

a) Detailed history was taken from the victims or relatives of the patients admitted with suspected snake bite with features of envenomation.

b) Full clinical examination was done and recorded in pre-designed proforma.

c) Routine examination of urine, bleeding time and whole blood clotting time was done.

d) Those patients showing clinical features of envenomation were subjected to complete blood count including platelet count, prothrombin time (PT), activated partial thromboplastin time (APTT) and biochemical examinations such as serum urea, creatinine, sodium, potassium.

e) The patients were administered AVS as per schedule after admission. The time interval between bite and administration of AVS was noted. The patients were then prospectively studied for the development of acute renal failure and respiratory paralysis. Acute renal failure defined as serum creatinine >1.5 mg/dl or oliguria <400 ml/day in absence of pre-existing renal disease and respiratory paralysis as single breath count <20 in absence of pre-existing lung disease. The ability to reach 20 corresponds to vital capacity of greater than 1.5 litres.

f) The study subjects who developed acute renal failure and respiratory paralysis were noted. Statistical test was used to study the relationship between the timing of AVS administration after snake bite (bite to needle time) with development of acute renal failure and respiratory paralysis.

g) The endpoint of the study was normalization of haematological and neurological parameters or death of the patients.

Analysis of data: All collected data was analysed by appropriate statistical methods using suitable softwares SPSS version 20.

RESULTS

The study shows following:

Epidemiology: Maximum numbers of cases (70.5%) were in the age group of 13-40 years, while only 9.83% were above the age of 60 years (Table 1).

Table 1: Distribution of study subjects according to age (n=122).

Age (years)	Cases	
	No.	Percentage
13-20	18	14.76
21-30	34	27.87
31-40	34	27.87
41-50	18	14.76
51-60	6	4.91
>60	12	9.83
Total	122	100

In the present study males were 55.74% and females 44.26%.

In this study most (63.93%) snake bite victims are related to agricultural work.

Site of bite: 66.95% of cases of bite occurred in the lower extremity (Table 2).

Time of bite: In this study 62 (50.82%) bites occurred during day time and 60 (49.18%) bites during night time. Among 62 bites during day time, 44 (36.07% of total) bites were vasculotoxic and among 60 bites occurred during night time, 18 (29.51% of total) bites were neurotoxic. This association was significant with p value of 0.01 (Table 3).

Time of AVS administration: 67.22% of snake bite victims were admitted to the hospital and received AVS within 6 hours of snake bite.

Table 2: Distribution of study subjects by site of bite (n=122).

Site of bite	Cases	
	No.	Percentage (%)
Palm	22	16.39
Forearm	10	8.20
Arm	10	8.20
Foot	60	49.18
Calf	14	11.47
Thigh	4	3.28
Ear	4	3.28
Total	122	100

Table 3: Distribution of study subjects by time of bite and type of bite.

Time of bite	Type of bite		Total No (%)	OR 95% CI	Chi Sq. p
	Vasculotoxic No. (%)	Neurotoxic No. (%)			
6.00 am - 6.00 pm (Day)	44 (36.07)	18 (14.75)	62 (50.82)	3.667	5.93
6.00 pm - 6.00 am (Night)	24 (19.67)	36 (29.51)	60 (49.18)	1.26-10.64	0.0149
Total	68 (55.74)	54 (44.26)	122 (100)	-	-

Clinical features: Most common constitutional symptoms include abdominal pain followed by vomiting (Table 4). Pain at the site of bite was most common local symptom (83.60%) followed by vomiting (55.73%), local cellulitis (52.46%) and blister formation (11.48%) (Table 5).

Table 4: Distribution of study subjects according to constitutional symptoms (n=122).

Constitutional symptoms	Cases	
	No.	Percentage
Vomiting	68	55.73
Abdominal pain	36	29.50
Fright	54	44.26
Giddiness	8	6.65

Table 5: Local manifestations in study subjects (n=122).

Symptoms and signs	Cases	
	No.	Percentage
Pain at local site	51	83.60
Local cellulitis	32	52.46
Blisters	7	11.48
Regional lymphadenopathy	7	11.48

Neurotoxicity: In our study 54 among 122 developed neurotoxic manifestations (44.26%). In that ptosis was most common presentation (44.26%) followed by drowsiness (27.86%), difficulty in swallowing (29.5%), speech (21.31%), ophthalmoplegia (19.67%) and respiratory paralysis (18.03%) (Table 6).

Table 6: Neurological symptoms and signs in study subjects (n=122).

Symptoms and signs	Cases	
	No.	Percentage
Ptosis	54	44.26
Difficulty in swallowing	36	29.50
Difficulty in speech	26	21.31
Drowsiness	34	27.86
Ophthalmoplegia	24	19.67
Respiratory paralysis	22	18.03

Vasculotoxicity: Haematuria was observed in 29.5% of cases followed by bleeding gums (13.11%), haematemesis (9.83%) melaena (6.55%), haemoptysis (4.91%) and cerebral haemorrhage in the 1.63% cases (Table 7).

Renal failure: Renal failure was observed in 38 cases (31.14%) among 122 cases of poisonous snake bites. Haemodialysis therapy was given to 24 cases (19.67%).

Respiratory failure: Among 122 cases 22 developed respiratory paralysis (18.03%).

Table 7: Hemostatic disturbances in study subjects (n=122).

Symptoms and signs	Cases	
	No.	Percentage
Haematuria	36	29.5
Haematemesis	12	9.83
Bleeding gums	16	13.11
Melaena	8	6.55
Cerebral hemorrhage	2	1.63

Association among age and ARF and respiratory paralysis

An attempt was made to study the association between the age with subsequent development of ARF and RP. Chi square test for trend was used to find out the significance of the association. It was found that the increment of age increases the risk of development of ARF and RP after snake bite though it was not statistically significant (p=0.164) (Table 8).

Table 8: Association between age distribution and development of ARF and RP.

Age (years)	Cases			
	Total No. (%)	Developed ARF No. (%)	Developed RP No. (%)	Not developed ARF and RP No. (%)
13-30	52 (42.62)	12 (9.83)	10 (8.20)	30 (24.59)
31-50	52 (42.62)	16 (13.12)	8 (6.55)	28 (22.95)
>50	18 (15.86)	10 (8.20)	4 (3.28)	4 (3.28)
Total	122 (100)	38 (31.15)	22 (18.03)	82 (50.82)

Association among bite to needle time and development of ARF and RP

An attempt was made to study the association between the time of AVS administration (bite to needle time) with subsequent development of ARF and RP. Chi square test was used to find the significance of this association. It was found that patients receiving AVS at or after 6 hours were more likely to develop ARF and RP compared to patients receiving AVS before 6 hours. It was found to be significant, p=0.0029 (Table 9).

Table 9: Association between bite to needle time with development of ARF and RP.

Bite to needle time	Cases			Total No. (%)
	Developed ARF No. (%)	Developed RP No. (%)	Not developed ARF and RP No. (%)	
<6 hours	20 (16.39)	10 (8.20)	52 (42.62)	82 (67.21)
6-24 hours	14 (11.48)	12 (9.83)	10 (8.20)	36 (29.51)
>24 hours	4 (3.28)	0	0	4 (3.28)
Total	38 (31.15)	22 (18.03)	62 (50.82)	122 (100)

DISCUSSION

Snakebite still remains an important cause of accidental death in modern India, and its public health importance has been systematically underestimated. It is an important occupational injury affecting plantation workers, construction labourers, and farmers working in fields.

The high incidence in the age group of 13-40 years in this study is because of occupational exposure, this being the productive age group. The high incidence of snake bites in males is probably due to their lifestyle behaviour and nature. This is same with other studies.[12] This study showed that lower limb was the most common site of bite which is in accordance with several other studies from south East Asia.[13]

This study showed that vasculotoxic nature of bite was more common during day and neurotoxic bite was more during night time**.** This is in accordance with Kularatne et al.[14] Ariratnam CA et al.[15] and several other studies.

Almost two third patients were admitted and administered anti venom serum within 6 hours. That is

may be due to location and transportation facility of the area, patients belonged to. That had helped them to avoid unnecessary delay in getting treatment.

Pain at the site of bite was a common symptom followed by local cellulitis and blister formation which is similar to studies by Rodney E et al and Saini RK et al.[16,17]

Ptosis was the earliest and commonest symptoms of neurotoxic snake bite in this study which is similar to other studies but the occurrence of symptoms is much lower compared to those studies by Saini et al.[17] and Virmani SK et al.[18]

Haematuria was the commonest symptoms of vasculotoxic snake bite in this study which is similar to other studies but incidence of epistaxis is much rarer compared to those studies.[18]

Incidence of respiratory failure is almost same with other studies whereas renal failure is low compared to other studies and the outcome of dialysis is also very good.[19]

Study revealed that older patients were more prone to develop ARF than younger patients though it was not statistically significant (Chi square for linear trend: 1.93829, p=0.164 at degree of freedom 2). This is very similar to study conducted by Ganesh Anthappan et al.[20]

Significant association ($p<0.05$) ($p=0.0029$ at the degree of freedom 1) was found between time of AVS administration and development of ARF and/or RP. Patients receiving AVS at or after 6 hours were more likely to develop Acute Renal Failure (ARF) and Respiratory Paralysis (RP) compared to patients receiving AVS before 6 hours.

This finding is similar to the observation made by Vijeth SR et al. that the incidence of complications was directly proportional to the duration of venom in the blood prior to neutralisation by AVS.[21] This fact is also proved by Ash T et al.[22] and Thomas L et al.,[23] who documented a positive correlation between severity of renal failure and increased time interval between bite and AVS administration.

However owing to the lack of facility for blood venom level estimation in our institute it was not possible to correlate level of venom in blood with complications.

CONCLUSION

The fact that the incidence of complications was directly proportional to the duration of venom in the blood prior to its neutralisation by AVS due to late arrival of patient at hospital, point to the possibility of direct toxicity of venom on organ systems of the body. Based on the findings of the present study, we suggest that the early institution of AVS is beneficial to prevent complications in the form of ARF and respiratory paralysis.

It may be noted that in rural India where the snake bite is a common phenomenon, timely availability of anti venom is at times a problem. This delay in AVS administration could increase the incidence of ARF, respiratory paralysis and morbidity as observed from the present study.

Hence, the need of the hour is to make the availability of AVS universal in the areas where incidence of snake bite is high and to adequately train the health care providers and staff about the appropriate management of snake bite patients in order to decrease the morbidity and mortality in years to come.

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