

Severity Grading, Management, Outcome and Epidemiological Profiling of Snakebite Victims in Tertiary Care Hospital in South India: 5 Years Retrospective Study

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Abstract

Objective: We conducted this study to do epidemiological and clinical profiling of the patients with snake bite in a tertiary care referral centre, situated in suburban area of Dakshin Kannada district, Karnataka, south India.

Materials and Method: This retrospective, record based study was done by analysing medical records of all the patients of snake bite admitted over 5 years from June 2015 to July 2019. It included demographic details and clinical profiling. Based on presenting complaint, clinical sign/symptoms and laboratory reports snake envenomation patients were divided into neurotoxic and hemotoxic group. The severity grading, amount of ASV used and outcome assessed in both the groups.

Results: Total 108 patient records were analysed, maximum of which were males (64.8%) in age group of 15-30 years (46.2%). In majority of the cases the species of snake was not identified (67.5%). Dry bites were reported in 40.7% cases, among envenomated cases, 68.7% presented with hemotoxic syndrome, 29.7% with neurotoxic syndrome and 0.9% had both the features. In all envenomated patients with increasing bite to needle time, the grade of severity, amount of used ASV, duration of hospital stay and complications were found to increase.

Conclusion: Snake bite is a neglected life threatening condition, which is a preventable disease. Tourniquet is still very commonly used first aid technique, which can be deleterious. The lack of education and awareness about snake bite management was evident and active mass education is clearly needed.

Key words: Snake envenomation, severity grading, Clinical profile and outcome

Introduction

There are almost 216 species of snakes in India and out of these only 60 are considered as poisonous¹. In India, there are mainly four species of snake majorly poisonous; cobras or *Naja naja*, krait or *Bungarus caeruleus*, Russell's viper or *Daboia russelli*, and saw-

scaled viper or *Echis carinatus*². All snake bite does not lead to envenomation, 70% of all snakes are non poisonous and poisonous snakes envenomate only in 50%³ of cases. Snake envenomation is a medical emergency. In 2009 WHO enlisted snake bite as neglected tropical condition⁴. According to WHO report, maximum number of snake bite has been reported from South Asia, Southeast Asia, and sub-Saharan Africa^{5,6}. Every year highest number of mortality due to snake envenomation occurs in India, which ranges from 5,000 to 13,000 cases annually^{5,6}. The exact mortality due to snake bite may be even higher in India as many deaths go unreported in rural areas.

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Clinico - toxicologically, nature of snake envenomation is categorized into hemotoxic, neurotoxic, and myotoxic syndromes⁷. We undertook this research for clinico-epidemiological profiling, and to find the risk factors which affects the outcome of different snake envenomation.

Methodology

The present retrospective, record based study was done in Srinivas Institute of Medical Science & Research Centre (SIMS&RC), on all the patients of snake bite admitted over a period of 5 years, from July 2015 to June 2019. It is the only tertiary care health facility in 20 km area, serving population of Mangalore city, suburban outskirts of Mangalore city, rural population of Udupi district, adjoining districts of coastal Karnataka and northern districts of Kerala.

Recorded information was entered in a pre-coded proforma which included demographic and clinical data. The data related to part of the body which was bitten, any first aid/ traditional treatment received, time to reach hospital after snake bite and time in receiving ASV after bite (bite to needle time) were collected for the entire patient. If snake species was identified at time of bite, that was also noted.

It is the hospital policy to admit all snakebite patients to Intensive care unit (ICU) and get done complete blood count, coagulation profile, renal function test, serum electrolytes including sodium, potassium and chloride. Patients were followed for 24 hours for “dry bite” confirmation and discharged after a day. In ICU, the 20 WBCT (whole blood clotting test) was done to assess venom induced defibrinogenation⁸ and used as a guide for further dosing of ASV in hemotoxic patients. Patients with signs of envenomation were administered ASV, which is known to cause allergic reaction, shock, anaphylaxis and serum sickness, these were also looked in the records.

Cobras and krait both belongs to elapid family and their envenomation leads to neurotoxic and cardiotoxic features⁸, local effects are supposed to be more common with cobra envenomation but by medical record evaluation it was difficult to differentiate both species. Russell’s viper and saw-scaled viper venoms are vasculotoxic⁸ and produce severe necrotising local effects. So for evaluation, all the patients of envenomation were majorly divided into two groups, neurotoxic group and hemotoxic group. According to the

presenting complaints we tried to grade the severity of snake bite from grade 1 (mild) to grade 4 (very severe) in both hemotoxic and neurotoxic group, based on Kumar et al study⁹. The amount of ASV received according to the grade of severity also noted.

Results

A total of 108 patients of snake bite were admitted to the hospital during the study period. The maximum numbers of snake bite patients were reported in month of July-September and none in the months of January and February. Most of the patients were bitten during 6-11pm (77, 71.29%), at residence and roadside while walking (76, 70.37%) and in lower extremity (67, 62.03%).

Table 1: Demographic details

Characteristics	Number (%)
Gender	
Male	70(64.81%)
Female	38(35.18%)
Age distribution (years)	
<15	12(11.1%)
15-30	50(46.29%)
30-45	19(17.59%)
45-60	20(18.51%)
>60	7(6.48%)
Months	
January-March	10(9.25%)
April- June	28(25.92%)
July-September	40(37.03%)
October-December	30(27.77%)
Occupation	
Students	42(38.88%)
House wife	30(27.77%)
Private job	25(23.14%)
Plantation worker	11(10.18%)
Educational status	
Illiterate	18(16.66%)
Students	29(26.85%)
Completed primary education	61(56.48%)
Alternative treatment	
No first aid	73(67.59%)
Tourniquet	32(29.62%)
Others(lemon juice application)	1(0.92%)

One patient had reached hospital after 3 days due to cellulitis at the site of bite; she had earlier received ASV in some other centre, as all the information was present in the medical record so she was not excluded from the study. In majority of the cases the cause of delay was because of not considering it dangerous. Maximum patients did not receive any first aid and 2 (1.8%) patients arrived with immobilisation.

Table 2: Snake species identification and site of bite details

Characteristics	Number (percentage)
Species of snake	
Rusell’s viper	22(20.37%)
Krait	10(9.25%)
Non poisonous snake	2(1.85%)
Sea snake	1(0.92%)
Unidentified	73(67.59%)
Fang marks	
Two	65(60.1%)
Scratches	21(19.4%)
Four	1(0.9%)
No definitive mark	21(19.4%)

Dry bite was confirmed in 44 (40.74%) patients. Out of 64 cases of snake envenomation, 44(68.75%) were categorised as hemotoxic and 19(29.7%) were categorised as neurotoxic syndrome. One patient had presented within half an hour of Krait bite in hand which was sustained while cutting tree, two fang marks were present, profusely bleeding from the site of bite, tourniquet was tied, drooping of eyelid, difficulty in speaking, blurred vision and gait abnormality were present. On investigation, coagulopathy was present (INR 7.8). He left against medical advice in view of financial constrains.

Severity grading of hemotoxic envenomation, management and complications

Pain was found to be the most common presenting complaint in 41(93.1%) patients, followed by swelling in 29(65.9%), discolouration in 28(63.63%), local rise of temperature in 12(27.27%) and blisters in 4(9.09%) patients respectively. Bleeding from the fang wounds, hematemesis and hematuria were present in 5(11.36%), 4(9.09%) and 5(11.36%) patients respectively. Coagulopathy and cellulitis were reported to be the most common complication in 39(88.63%) and 24(54.54%) patients. Ulceration in the limb, renal failure, sepsis, necrotising fasciitis and compartment syndrome were other complications noted in 10(22.72%), 8(18.18%), 8(18.18%), 5(11.36%) and 4(9.09%) patients respectively. All the cases of renal failure managed conservatively. Surgical interventions were needed in 11(25%) patients. Blood products were transfused in 27(61.36%) patients. No mortality recorded.

Table 3: Severity grading of hemotoxic group

Grade	Total number of patients	Mean ASV vials used (range of vials)	Requirement of ventilator support	Duration of hospital stay in days, mean(range)	Mortality
Grade 1	5	11(10-15)	0	4.2(3-5)	0
Grade 2	14	15.71(10-20)	0	5.71(5-9)	0
Grade 3	15	24(10-40)	0	6.3(5-9)	0
Grade 4	10	33(30-45)	0	7.8(5-28)	0

Severity grading of neurotoxic envenomation, management and complications

Ptosis was found to be the most common presenting complaint in 18(94.73%) patients, followed by external

ophthalmoplegia in 11(57.89%), pain in 6(42.85%), swelling in 6(42.65%), abdominal pain in 4(21.05%), vomiting in 3(15.78%), discolouration in 3(15.78%), blisters in 3(15.78%), local rise of temperature in 3(15.78%), bulbar weakness in 3(15.78%) and gait

abnormality in 2(10.52%) patients respectively. Significant respiratory weakness was found in 2 patients, they were managed by endotracheal intubation. They improved after ASV administration and extubated after a day. Renal failure, cellulitis and gangrene were other reported complications in 4(21.05%), 4(21.05%) and 1(0.95%) patients respectively.

Table 4: Severity grading of neurotoxic group

Grade	Total number of patients	Mean ASV vials used (range of vials)	Requirement of ventilator support	Duration of hospital stay in days, mean(range)	Mortality
Grade 1	7	12.85(10-15)	0	4.85(4-5)	0
Grade 2	6	17.5(15-25)	0	6.5(4-12)	0
Grade 3	0	0	0	0	0
Grade 4	6	34.16(25-40)	2	7(5-10)	0

Table 5: Correlation of bite to needle time (time to receive ASV after snake bite) and severity grading

Bite to needle time	Grade 1	Grade 2	Grade 3	Grade 4
<6 hours	12	18	11	2
6-24 hours	0	2	4	12
>24hours	0	0	0	1

Table 6: Amount of ASV used in hemotoxic and neurotoxic group in relation to tourniquet

Hemotoxic group	Grade 1	Grade 2	Grade 3	Grade 4	Mean
Amount of ASV used(mean) in patients with tourniquet	15 (n=1)	20(n=5)	38(n=5)	45(n=2)	29.5
Amount of ASV(mean) used in patients without tourniquet	10(n=4)	13.3(n=9)	17(n=10)	35(n=8)	18.82
Neurotoxic group					
Amount of ASV used(mean) in patients with tourniquet	15(n=1)	20(n=2)		40(n=3)	25
Amount of ASV(mean) used in patients without tourniquet	12.5(n=6)	16.25(n=4)		28.3(n=3)	19.01

The mean dose of ASV which was given for the neurotoxic snake bites was 21.5 vials (range 10-40 vials) and 20.92 vials (range 10-45) were given for the hemotoxic bites.

Allergic reactions to ASV were noted in 8 (12.63%) cases (pyrexial reaction in 6 cases, and urticarial reactions in 2 cases).

Risk factor assessment

Delay in presentation to hospital lead in increase in grade of severity. Application of tourniquet lead to increased requirement of ASV.

Discussion

The study was conducted in SIMS&RC, which is situated in suburban area of Mangalore, Dakshin Kannada district, Karnataka, South India. The Dakshin Kannada district is sheltered by Western Ghats on the east, which is the only remaining rain forest in India and home to several species of reptiles¹⁰.

We explored medical records of 108 snakebite victims and found that mostly young males in age group of 15-30 years were victims bitten by the snake in the lower limb, which may be because ambulant population are at higher risk of snake bite. The maximum bites reported in months of July – September, which is the monsoon season and activity of snake increases during that season¹¹, which was in close agreement to previous studies¹¹⁻¹⁴. Most of the patients were bitten during the time of dusk and night at residence and roadside while walking, which was due to diminished vision and accidentally stepping on the snakes. Occupationally most of the victims were students and house wives, which were unlike other studies where agriculture was most common occupation^{14,15}. It may be the result of occupational difference in the population. Agriculture is not a major occupation of people in Dakshin Kannada¹⁶.

Contrary to the major believe that all snake bite results in envenomation, we found that 40.7% patients were either bitten by non poisonous snakes or there was no envenomation (dry bite) in case of poisonous snake bites. The studies conducted in other states of India, like Kerala found 66%¹⁷ dry bite cases and in Himachal Pradesh it was found to be 43%¹².

In current study, maximum patients reported to hospital within 6 hours of bite and early arrival lead to lesser degree of severity. The amount of ASV used was

found to be higher in severe grades and duration of stay was also longer due to development of complications. The direct correlation of early presentation and better outcome has earlier been demonstrated in other studies^{11, 18}. There was no mortality reported in our study which could be because of early presentation of the patient to the hospital.

In current study, 29.6% patients came with tourniquet, in other studies conducted in South India almost 30¹⁹-50¹⁵% patients came with tourniquet application. The tourniquet is known to be potentially dangerous in snake bite cases as it leads to gangrene, increased fibrinolysis, bleeding in the occluded limb, peripheral nerve palsies and intensification of local envenomation⁸. In current study it was found that the amount of ASV used in same grade of severity was more in the patients with tourniquet application in both hemotoxic and neurotoxic groups.

Maximum patients (73, 67.59%) did not receive any first aid. The knowledge to immobilise the bitten part of the body, as muscle contraction promotes venom absorption⁸, was majorly lacking. Only 2 patients arrived with splint. The need of mass education about first aid of snake bite was obvious.

Hemotoxic syndrome was more common among envenomated patients that neurotoxic syndrome, which could be the result of more prevalence of Viper snakes in the region. This finding was in close accordance to studies conducted in neighbouring regions^{11,14,15}. The average ASV used was more in neurotoxic group, which may be because the elapid venom are small molecules, gets rapidly absorbed in the blood stream and needs higher dose of ASV for neutralisation^{8,11}.

In hemotoxic group, coagulopathy was most common complication followed by cellulitis, ulceration in the limb, renal failure, sepsis, necrotising fasciitis and compartment syndrome. These results were almost similar to other studies conducted on viper snake bite patients^{11, 19,20}. In neurotoxic group; ptosis, external ophthalmoplegia, pain, swelling at the site of bite, abdominal pain, vomiting, discolouration, blisters, local rise of temperature, bulbar weakness and gait abnormality were presenting features, which were comparable to other studies done earlier^{8,12}.

To summarise, India is capital of snake bites²¹ so we need to focus on mass education about first aid and importance of early arrival in management of snake bite.

The amount of venom absorption can be decreased by immobilisation and early administration of ASV can cure the disease. The alternative treatment in any form can be deleterious and can make the prognosis poor.

Limitation:

It was a retrospective study so few data may be missing. Snake species identification was limited to very few cases so species specific severity grading could not be done. As neuroparalytic features were common to both Cobra and Krait, it was difficult to differentiate both the species based on medical record data evaluation, so both analysed together.

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Conflict of Interest: There are no conflicts of interest.

Ethical Approval: The study was approved by the ethics committee of Srinivas Institute of Medical Sciences & Research Centre, Mangalore.

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