Original Article

A Study of Clinical Predictors of snake bite patients and its relation with mortality at tertiary care hospital

Sainath Hiwrale[1], Rohit Salame[2], B S Yelke[3]

ABSTRACT

Background : Snake bite is a life threatening emergency and still represents an important health problem in the tropical world. The annual death rate due to snake bite in India is estimated to be 4.1 per 1,00,000 population, while in Maharashtra it is 3.0 per 1,00,000 population.

Aims and Objectives :

- To study, the clinical profile of snake bite on admission and its relationship with the outcome in terms of survival and non-survival.
- To study the effect of time interval between snake bite to first dose of ASV with the outcome.

Methodology : It was prospective observational study,included 266 cases of poisonous snakebite of age > 12 years admitted in emergency ward, medicine wards and MICU of tertiary care hospital between 1st Nov 2014 to 31st Oct 2016.Patient of non-poisonous snakebite, scorpion bite, referred cases from primary and secondary center without ASV or with ASV doses in known, mentioned quantity were excluded from the study. Demographic characteristics, signs and symptoms, bite to injection time of ASV and total dose of ASV administered and complication were documented.

Results : The majority of patients (46.6%) were in the age group of 20-40 years with male (59%) predominance. Most common type of snake bite was vasculotoxic (68.8%) and common site was lower limb (52.26%).60% of the patients were admitted in monsoon season. Various clinical presentations observed were local swelling (66.17%), vomiting (35.71%), slurred speech (22.93%), colour changes in form of bluish discoloration of bite site (16.92%), diplopia (21.80%), respiratory distress (14.29%), oozing from bite site (12.78%), ptosis (30.83%), haematuria (11.28%), and shock (3.75%). Of the 266 patients included in the study, Neuro-paralysis, DIC, acute renal failure were the dreadful complication and predictors of mortality, overall mortality was 6.8 % i.e. 18 patients succumbed. Mortality in those cases who received ASV after 24hrs of bite was 42.85%.Mean duration of hospital stay was 5.496 days.

Conclusion : In order to reduce mortality by Snake bite, it is important for a patient to reach the hospital as early as possible to get appropriate and adequate treatment with Anti Snake venom to prevent the development or progression of complications with proper intervention.

Keywords : Snakebite, Vasculotoxic, Diplopia, DIC, Ptosis.

Introduction :

Snake bite is one of the common causes of mortality and morbidity in India, particularly in rural areas. All the snakes are generally considered as poisonous, in the sense that venom in their saliva is sufficient to kill or paralyze their prey. Fact is that majority of them are non poisonous. About 2500 species of snakes exist in the world. India has over 250 species and subspecies, out of which 50 are venomous[1]. Overall, in world mortality from snake bite is estimated as 50,000 to 1,00,000 annually and the greatest number of reported snake bite death occurring in Indian subcontinent is 10,000 to 15,000 annually[2]. In addition, World Health Organization (WHO) reports 40,000 annual deaths in tropical countries. Largest numbers of deaths reported in India are from Bengal, Uttar Pradesh (UP), Tamil Nadu, Bihar, and Maharashtra[3]. Every year about 2000 death occurs due to snake bite in Maharashtra. Many patients in rural areas remain unreported because many villagers seek traditional treatment and many die at home or during transport to hospital and valuable time is lost in such non-effective

[1]Assistant Professor, [2]Assistant Professor, [3]Professor and HOD, Department of General Medicine, SVNGMC, Yavatmal, Maharashtra-445 001, India

Address for Correspondence -
Dr. Rohit Salame
E-mail : rohit1241986@gmail.com

Received on 17th December 2019 Accepted on 26th December 2019

treatment[4]. It is important to have proper regimens and modality of treatments in the event of complications in snake bite patients. Hence, the present study was undertaken to assess the clinical parameters, management and outcome in patients of poisonous snakebite.

Materials and Methods :

It was a prospective observational study conducted on 266 poisonous snake bite patients satisfying the inclusion and exclusion criteria during the period of two years from 1st Nov 2014 to 31st Oct 2016 were included in the study.

Inclusion Criteria : All the poisonous snakebite cases of age >12 years admitted in emergency ward, medicine wards and medical intensive care unit (MICU) of tertiary care hospital were included in study.

Exclusion Criteria : Patient of non-poisonous snake bite, scorpion bite, any other animal bites, snake bite patient of age <12 years, cases which have taken Discharge Against Medical Advice (DAMA) during treatment, snakebite cases referred from primary and secondary center with ASV of unknown quantity were excluded from the study. Institutional Ethical Committee approval and written and verbal consent of patient were obtained for the study.

Demographic characteristics of the patient, such as age, gender, region, locality of patient, time of bite, site of bite on body, bite-to-ASV dose time were recorded. Symptoms and signs such as pain, local swelling, vomiting, slurred speech, ptosis, hematuria, local colour changes at bite site, hypotension, respiratory distress, bite to injection time of anti-snake venom (ASV), total dose of anti-snake venom administered and duration of hospital stay were documented. Most important investigation performed in Vasculotoxic snake bite was 20 minute whole blood clotting time (WBCT) which helps in early detection of coagulopathy and subsequent development of acute renal failure. Complete blood count, liver function test, renal function test, coagulation profile wasalso done. Primary outcome of snake bite case was defined in the form of survival or non-survival.No follow up has been taken after discharge of patient.

Data Analysis :

Collected data was entered in MS-Excel 2010 and analyzed using SPSS 16.0 version. The comparison of qualitative data was done using chi-square test. The confidence limit for significance was fixed at 95% level with p-value < 0.05.

Observations and Results :

A total 266venomous snake bite cases were included in the study which ranged from 12 to 78 years of age with mean age 36.89 ± 15.252 years. The maximum snake bite cases were in the age group of 21-30 and 31-40 years i.e. 23.3% in each age group. Among all the cases, most common type of snake bite was vasculotoxic (68.8%), followed by 22.2% of pure neurotoxic and 9% mixed type as depicted in **Table 1.**

Snake bite cases are more common in rural areas. The detailed demographic profiles of the snake bite cases have been presented in ***table 2.*** Out of 266 patients, 59% cases of snake bite were males and 41% were female respectively. Around 200 (75.2%) cases were unable to identify bitten snake species correctly as compared to

Table 1 : **Snake Bite Type with Age Group**

Age in years	Snake Bite Type			Total
	Vasculotoxic	Neurotoxic	Mixed	
12-20	26	9	11	46 (17.3%)
21-30	41	18	3	62 (23.3%)
31-40	43	16	3	62 (23.3%)
41-50	33	10	2	45 (16.9%)
51-60	23	3	4	30 (11.3%)
>60	17	3	1	21 (7.9%)
Total	183 (68.8%)	59 (22.2%)	24 (9%)	266 (100%)

presenting features and considered as unidentified snake species. Among identified snake species, viper was most common snake-in 42 (15.8%), followed by cobra in 16 (6%) and krait in 8 (3%).

The lower extremity was the commonest site on the body for snake bite. Seasonal variation in the incidence of snake bite was observed in the study, with 59.02% of bites in monsoon season (June-September); this may be due to destruction of snake shelters and increased agricultural activity.

Table 3. Signs & Symptoms depending upon the snake bite. Clinical presentation in decreasing order of incidence were local swelling (66.17%), vomiting (35.71%), ptosis (30.83%), slurred speech (22.93%), diplopia (21.80%), colour changes in form of bluish discoloration of bite site (16.92%), respiratory distress (14.29%), oozing from bite site (12.78%), hematuria (11.28%), and shock (3.75%).

Table 2 : **Demographic factors of snake bite cases**

Factors		**No. of patients**	**Percentage**
Sex	Male	157	59
	Female	109	41
Locality	Rural	241	90.6
	Urban	25	9.4
Area of snake bite	Outdoor	215	80.8
	Indoor	51	19.20
Snake species	Unidentified snake species	200	75.2
	Viper	42	15.8
	Cobra	16	6
	Krait	8	3
Site of bite	Lower limb	147	52.26
	Upper limb	101	37.97
	Trunk	13	4.9
	Head/neck/face	5	1.9
Season	Monsoon	157	59.02
	Winter	62	23.30
	Summer	47	17.66

Table 3 : **Clinical symptoms and signs in different type of snake bite**

Symptoms	**Snake Bite Type**			**Total**
	Vasculotoxic	**Neurotoxic**	**Mixed**	
Local swelling	153	00	23	176 (66.17%)
Vomiting	55	30	10	95 (35.71%)
Slurred speech	00	45	16	61 (22.93%)
Diplopia	00	43	15	58 (21.80%)
Colour changes at bite site	39	02	04	45 (16.92%)
Respiratory distress	00	31	07	38 (14.29%)
Oozing from bite site	25	05	04	34 (12.78%)
Signs	**Vasculotoxic**	**Neurotoxic**	**Mixed**	**Total**
Cellulitis	153	00	23	176 (66.17%)
Ptosis	00	59	23	82 (30.83%)
Neuroparalytic Respiratory Weakness (SBCT<10)	00	31	07	38 (14.28%)
Hematuria	24	01	05	30 (11.28%)
Unconsciousness	00	12	04	16 (6.01%)
Shock	04	04	02	10 (3.75%)
Systemic Bleeding	10	04	02	16 (6.01%)

Table no 4 showed Correlation between door to needle time and mortality. Most of the cases reported within 6 hours of the bite. Mortality in cases who could receive ASV after 24hours of bite was 42.85% as compared 1.03% in those cases who received ASV within 6 hours. Thus, the outcome was better in cases who received ASV earlier. Statistically it was found highly significant with p<0.0001. Of 266 snake bite patients, 18 patients died during the study period with an overall mortality of 6.8 %.

Table 4 : **Time between snake bite to 1st ASV dose as well as total dose of ASV in relation with outcome**

Time between snakebite to 1st ASV dose (in hrs)	Outcome		Total (n=266)	P -value
	Survival (n=248)	Non-survival (n=18)		
≤ 6	193 (98.97%)	2 (1.03%)	195 (100%)	<0.0001
6 to 12	37 (80.43%)	9 (19.56%)	46 (100%)	
12 to 24	14 (77.78%)	4 (22.22%)	18 (100%)	
> 24	4 (57.14%)	3 (42.85%)	7 (100%)	
Total dose of ASV(ml)	**Survival (n=248)**	**Non-survival (n=18)**	**Total (n=266)**	**P-value**
≤ 300	154 (96.25%)	6 (3.75%)	160 (100%)	0.016
>300	94 (88.68%)	12 (11.32%)	106 (100%)	

Table no 5 shows different complications of snake bite developed during hospital stay and mortality. Out of 194 cases of progressive cellulitis, 8 cases died i.e. mortality was 4.12%. Mortality in neuroparalytic respiratory failure was 15 (36.6%), in ARF was 6 (22.22%), in gangrene was 4 (18.18%), in shock was 14 (77.78%), in DIC was 7 (70%), in hypoxemic encephalopathy was 11 (100%).Complications like neuroparalytic respiratory failure, DIC, shock, acute renal failure were the major complication causing mortality in snake bite cases in our study which was found statistically highly significant (p<0.0001). These complications were major contributory factor for mortality and predictors for death in case of snake bite.

Table 5 : **Different Complication in relation with outcome**

Complications	Number of patients			P-value
	Survival (N=248)	Non-survival (n=18)	Total Cases	
Progressive Cellulitis	186	8	194	0.005
Neuroparalytic Resp. Failure	26	15	41	<0.0001
ARF	21	6	27	0.001
Gangrene	18	4	22	0.026
Shock	4	14	18	<0.0001
DIC	3	7	10	<0.0001

Table no 6 shows the different laboratory investigations done in our study. Mortality in those cases who's INR > 1.2 was 10 (9.17%), PT prolongation to 19 seconds 8 (25%), positive 20 WBCT 12 (6.67%), TLC > 11000/mm3 9 (9.9%), Sr. Creatinine > 1.5 mg/dl was 8 (17.8%), platelets < 1.5 lac/mm3 was 4 (19.05%) and Sr. Na<135 mEq/L was 8 (25.8%) respectively. Laboratory parameters like prothrombin time >19sec, serum creatinine, serum sodium were altered in the patients that died, was found to be statistically highly significant predictor of mortality (p<0.0001). Platelet count less than 150000/mm3 was found statistically significant in those patients who died (p=0.02). While INR >1.2, 20WBCT positive, increased TLC were not found significant in contributing to mortality in our study (i.e. p=0.193, p=0.925 and p=0.144 respectively). This might be due to mortality in vasculotoxic snake bite in our study were lesser than neuroparalytic snake bite deaths. These investigations are particularly helpful in vasculotoxic snake bite rather than neurotoxic snake bites.

Table 6 : **Different laboratorial investigations done in our study and its correlation with mortality**

Investigations	Number of patients			P-value
	Survival (N=248)	Non-survival (18)	Total (%)	
INR > 1.2	99	10	109	0.193
PT > 19 sec	24	8	32	<0.0001
20 WBCT POSITIVE	168	12	180	0.925
TLC > 11000 / mm3	82	9	91	0.144
Sr. CREATININE > 1.5mg/dl	37	8	45	0.001
PLATELETS < 1.5 lac / mm3	17	4	21	0.02
Sr. Na < 135 mEq/L	23	8	31	<0.0001

Table no 7 shows comparison between different management required in snake bite patient and its outcome. Many patients needed multiple managements in their treatment course in hospital. Mortality in snake bite cases who required mechanical ventilation, diuretics, debridement, fasciotomy and dialysis were 15 (36.59%), 5 (20%), 3 (15%), 2 (33.33%) and 2 (15.38%) respectively. Those patients of snake bite requiring mechanical ventilation, diuretics and procedure like debridement or fasciotomy had more mortality and showed statistically significant p valueof (p<0.0001), (p=0.006) and (p=0.008) respectively. Those patients required dialysis had no statistically significant relationship with its outcome (p=0.205).

Table 7 : **Relation between management needed and outcome**

Treatment		Number of patients		Total	P-value
		Survival (N=248)	Non-survival (18)		
Mechanical ventilation		26	15	41	<0.0001
Diuretics		20	5	25	0.006
Dialysis		11	2	13	0.205
Procedure	Debridement	17	3	20	0.008
	Fasciotomy	4	2	06	

As shown in figure no 1, most of the snakebite cases i.e. 178 (66.91%) stayed less than 5 days in our hospital. They were having less signs and symptoms without much complication and recovered early. Other 68 i.e. (25.56%) cases stayed between 6-10 days, followed by 14 patients i.e.(5.26%) for 11-15 days and 6 patients i.e.(2.26%) were in the hospital for more than 15 days. The length of hospital stay ranged from 1 to 26 days. The mean duration of hospital stay in our study was 5.496 days.

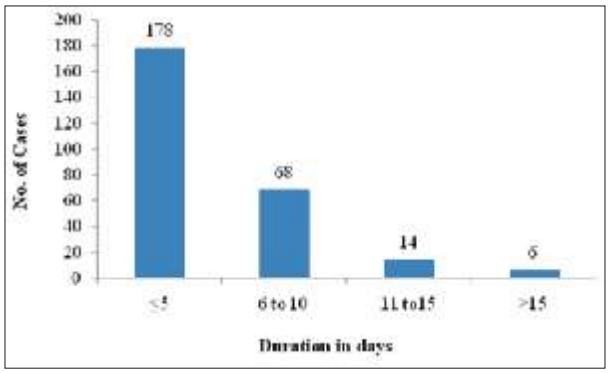

Figure 1 : **Duration of hospital stay**

Discussion :

The present study comprised of 266 snake bite patients with signs of envenomation during the period A meticulous history, clinical examination and laboratory investigation is carried out on the day of admission and regularly thereafter. Cases were followed till the final outcome in the form of survival or death. Data record included patients demographic profile, signs and symptoms, dose of ASV and complication of snake bite. This data was analyzed using statistical analysis.

In the present study, majority of patients were in the age group of 20-40 years (46.6%) with males predominant which is comparable with the other studies[5,6]. This age group consist of males who were working out in the field and agricultural activity as compared to young and elder group with less incidence. Vasculotoxic snakes i.e. Viperadae family of snake were responsible for maximum snake bites which is similar to the study done by **Pore et al[7] and Bhalla et al[8].**

The clinical presentation of vomiting, slurred speech, diplopia, respiratory distress, ptosis, neuroparalytic respiratory failure, unconsciousness, shock, systemic bleeding have statistically highly significant relation with mortality ($p<0.0001$). Local swelling / cellulitis and oozing from bite site have significant relation with mortality ($p=0.011$ and $p=0.001$ respectively).

Death rate was found to increase if the time interval between snake bite and ASV dose was more. Death rate was maximum (42.85%) in those cases who received ASV after 24 hrs and least (1.03%) in those cases who received ASV within 6 hrs. Thus the time interval between snake bite and ASV dose is directly proportional to mortality in snake bite. We observed that some delay in seeking medical aid was largely attributed to lack of awareness of hazards of snake bite, faith in healing by using manipulation of herbs especially among the illiterate, tribal, lower socio-economic sections of the community and lack of proper referral systems and transport facilities[17].

Laboratorial parameters like prothrombin time > 19sec, low platelet count, serum creatinine, serum sodium were altered in the patients who died and was found to be statistically highly significant predictor of mortality ($p<0.0001$). 20 WBCT positive, increased TLC were not found significant in contributing to mortality in our study i.e. $p=0.925$ and $p=0.144$ respectively. This might be due to mortality in vasculotoxic snake bite in our study were lesser than neuroparalytic snake bite deaths. These investigations are particularly helpful in vasculotoxic snake bite rather than neurotoxic snake bites. These results are concordance with the Kalantri, et. Al[5] and . **Redewad et al[13].**

Patients of snake bite requiring mechanical ventilation, dialysis and procedure like debridement or fasciotomy had more mortality. The length of hospital stay ranged from 1 to 26 days with mean hospital stay was 5.496 days which is similar to the study conducted by **Kalyani et al[5] and Redewad et al[13].**

In hospital based studies, mortality rates ranges from 3% to 20%. Mortality rate in our study was 6.8%. Overall mortality in a study conducted by Kalyani et al[5] and Halesha et al[16] was 4.5% and 3.8% respectively. The most common cause of mortality in our study was neuroparalysis followed by coagulopathy and acute renal failure. Apparently higher mortality rates in our study might be due to delay in arrival in hospital after snake bite for lack of transport facilities awareness.

Conclusion :

In order to reduce mortality by snake bite it is important for the patient to reach the hospital as early as possible so as to get administration of optimal ASV dose to prevent the development or progression of complications with proper intervention. Vomiting, neuroparalysis, WBCT and serum Creatinine are significant predictors of mortality amongst inpatients with snake bite. Those patient who develop dreadful complication like neuroparalysis, acute renal failure, coagulopathy may not be benefited by giving more amount of ASV (> 300 ml).

References :

1. Sarangi A, Jena I, Das JP. A Profile of snakebite poisoning with special reference to hematological, renal, neurological, electrocardiographic abnormalities. J Assoc Physicians India. 1977;25:555-60.
2. Vol. 10. WHO bulletin; 1954. Swaroop and Grab. Snake bite Mortality in world; p. 35.
3. Manson Bahr Poisonous snakes, Manson's Tropical Diseases. 1968;(Ch XL VII):749-60.
4. Sharma SK, Chappuis F, Jha N, Bovier PA, Loutan L, Koirala S. Impact of snake bites and determinants of fatal outcomes in southeastern Nepal. Am J Trop Med Hyg. 2004;71:234–8.
5. Kalyani P, Felix AJW, Arulmani A, Ambayiram AV. Clinico-epidemiological profile of snake bite reported in a tertiary care hospital in Tamilnadu. Asian J Pharm [Internet]. 2015;5(2):70-4.
6. Punde DP. Management of snake-bite in rural Maharashtra: A 10-year experience. Natl Med J India. 2005;18(2):71-5.
7. Pore SM, Ramanand SJ, Patil PT, Gore AD, Pawar MP, Gaidhankar SL, et al. A retrospective study of use of polyvalent anti-snake venom and risk factors for mortality from snake bite in a tertiary care setting. Indian J Pharmacol. 2015;47(3):270-4.
8. Bhalla G, Mhaskar D, Agarwal A. A Study of Clinical Profile of Snake Bite at a Tertiary Care Centre. Vol. 21, Toxicology International. India; 2014. p. 203-8.
9. Halesha BR, Harshavardhan L, Lokesh AJ, Channaveerappa PK, Venkatesh KB. A study on the clinico-epidemiological profile and the outcome of snake bite victims in a tertiary care centre in Southern India. J Clin Diagnostic Res. 2013;7(1):122-6.
10. Ahmed SM, Ahmed M, Nadeem A, Mahajan J, Choudhary A, Pal J. Emergency treatment of a snake bite: Pearls from literature. J emergencies, trauma Shock. 2008;1(2):97-105.
11. Kalantri S, Singh A, Joshi R, Malamba S, Ho C, Ezoua J, et al. Clinical predictors of in-hospital mortality in patients with snake bite: a retrospective study from a rural hospital in central India. Trop Med Int Health [Internet]. 2006;11(1):22-30.

12. Wanje S et al; Clinical profile of snake bite cases in marathwada, India. Indian J FundamAppl Life Sci ISSN [Internet]. 2011;1(4):93-9.
13. Redewad N, Bhaisare SD, Bansod Y V, Hire R. Management and Outcome Study of Snake Bite Cases in Central India. Sch J Appl Med Sci [Internet]. 2014;2:435-41.
14. Chaudhari TS, Patil TB, Paithankar MM, Gulhane R V. Predictors of mortality in patients of poisonous snake bite : Experience from a tertiary care hospital in Central India. Int J CritIllnInj Sci. 2014;4(2):101-7.
15. David S, Matathia S, Christopher S. Mortality Predictors of Snake Bite Envenomation in Southern India-A Ten-Year Retrospective Audit of 533 Patients. J Med Toxicol. 2012;8(2):118-23.
16. Halesha BR, Harshavardhan L, Lokesh AJ, Channaveerappa PK, Venkatesh KB. A study on the clinico-epidemiological profile and the outcome of snake bite victims in a tertiary care centre in Southern India. J Clin Diagnostic Res. 2013;7(1):122-6.
17. Ghosh S, Mukhopadhyay P, Chatterjee T. Management of Snake Bite in India. Vol. 64, The Journal of the Association of Physicians of India. India; 2016. p. 11-4.