



Prognostic Indicators in Snake bite: Management and Outcome Study of Snake Bite Cases in a zonal hospital in Jammu & Kashmir, India

Medicine

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ABSTRACT

Background : Snake envenomation is a neglected environmental and occupational hazard in our country which is infested with snakes ranging from 12,000 feet altitude above sea level of the Himalayas down to Cape Comorin with an estimated total of 50,000 national snakebite deaths in the Million Death Study. These cases are managed presently as per the WHO Guidelines. There are no validated regional protocols available for management of snakebite as per the region specific snakes

Methods : The objective of this study was to study the prognostic factors in management of snakebite. This was a single centre, prospective observational study of 80 patient of venomous snakebite. We also compared a regional protocol being followed in our centre with the WHO protocol of ASV administration.

Results : Our study has thrown interesting facts. There were 2 deaths in the WHO regime group (Case Fatality Ratio 2.5). Upper extremities were the most observed bitten part of body (60%). Majority of snakebites occurred between 1900 hrs to 0600 hrs (70%). The most common complication observed was Sepsis (60%) followed by Cellulitis (30%) and Acute Kidney Injury (AKI), 22.5%. Effective immobilization at peripheral MI Rooms lead to early (in less than 8 hrs) correction of coagulopathy in 70.8% case ($p < .001$). A Bite to needle time less than 4 hrs was associated with lesser complications (55.6% vs 100 %) and faster resolution of coagulopathy (66.7% vs 30.8%) which was highly statistically significant. The Accelerated regime fared better in our study as compared to the WHO Regime in terms of no mortality, correction of coagulopathy in less than 8 hrs (100% cases, $p < .001$), lesser complications and short duration of hospitalization.

Conclusion : Immobilization and the prompt transport of the snake bite victims to the hospital, along with the prompt administration of ASV with a target Bite to Needle time less than 4 hrs, remains the mainstay to reduce the morbidity and the mortality which are associated with snake bites. It will be prudent to carry out a larger clinical study prospectively to identify inadequacies in the management of snakebite and study the effectiveness of Accelerated Regime

KEYWORDS:

Snakebite, Prognostic indicators, Bite to Needle Time, Anti Snake Venom

INTRODUCTION

Snake envenomation is a neglected environmental and occupational hazard in our country specially for armed forces personnel deployed in unforgiving terrains harboring 216 identifiable species of snakes, of which 52 are known to be poisonous¹. Approximately 2,000,000 snake bites are reported in the country each year. The Million Death Study revealed that there are an estimated total of 45,900 national snakebite deaths² comprising 5% of all injury deaths and 0.5% of all deaths in India. This grave burden of mortality from snakebite mirrors that of some notorious infectious diseases; as is evident by the fact that there is one snakebite death for every two AIDS deaths in India³. Therefore, snakebite management should be accorded a priority commensurate with this burden.

Snake bite management relies heavily on the WHO Guidelines for management of snake bite in South east Asia Region^{4,5} employing polyvalent Anti Snake Venom (ASV) effective against the "Big Four"; Russells viper (*Daboia russelii*), Common Cobra (*naja naja*), Common Krait (*Bungarus caeruleus*) and Saw Scaled viper (*Echis carinatus*) administered when there are definite signs of Systemic envenomation evidenced by coagulopathy primarily detected by 20 minute Whole Blood Clotting Test (20WBCT) or visible spontaneous systemic bleeding; Neurotoxicity manifested by ptosis, external ophthalmoplegia, muscle paralysis, or in the presence of Local signs of Envenomation like rapidly progressing swelling. In case of Vasculotoxic snakebite, the WHO ASV strategy revolves around a pivot of "Six hour" time, its essence being the 20 WBCT test done six hourly and rendering the same dose of ASV (10 Vials) if the test is abnormal. This is postulated on the inability of the liver to replace clotting factors in less than 6 hrs period.

The potency of anti venom depends on its ability to bind venom components⁶ while they are still in the circulation. The clincher being that irreversible toxicity, like clotting factor deficiencies resulting from Venom induced Consumptive Coagulopathy (VICC)⁷, cannot be reversed by antivenom once the venom is bound to tissues.

Consequently, for anti venom to be truly efficacious, it must be administered early and swiftly, enabling it to bind to the venom components before they bind to their target tissues, rendering the⁶ hour latency advocated by WHO Guidelines as potentially harmful.

There are no validated regional protocols available for management of snakebite as per the region specific snakes. This is further compounded by the fact that some of the region specific snakes, like the Levantine Viper (*Macrovipera lebetina, Gunas*)⁸ and the Himalayan Pit Viper (*Gloydius himalayanus*) in J & K are not covered by the Polyvalent ASV. *Echis carinatus* (saw-scaled viper, carpet viper) is the most common snake in this region⁹. Due to the possibility of renal failure and bleeding due to *Echis carinatus* envenomation, there are case reports of more ASV being required in state of Jammu (ASV >100 ml) to correct bleeding disorder¹⁰.

In view of these glaring dilemmas the present study was conceived to determine the Prognostic factors in the management of snake bite and devising a Region Specific ASV Administration Protocol (Accelerated Regime- 20 WBCT done hourly and ASV given hourly) and compare it with the WHO Regime of ASV Administration (q 6 hourly) in terms of complications, reversal of coagulopathy, duration of Hospitalization etc.

Materials and Methods

Study design

This was a single centre, prospective observational study of 80 patient of snake bite satisfying the inclusion and exclusion criteria, admitted to the medical intensive care unit and acute wards during the period from October 2015 to October 2016 at a Tertiary care Zonal hospital in J&K. 60 patients were treated as per the WHO guidelines (WHO Regime) and 20 patients were treated as per the Accelerated Regime after we had 2 mortalities in the WHO Regime.

Inclusion criteria

All the adult patients of poisonous snake bite admitted in medical wards and intensive care unit.

Exclusion criteria

All patients of non-poisonous snake bite & scorpion bite.

Data collection

Demographic characteristics of the patients and the snake bite event such as age, gender, time of bite, site of bite, Bite-to Needle time were recorded. Symptoms and signs such as local swelling, vesicles, bullae, ecchymoses, ptosis, tachycardia, hypotension, impending respiratory failure by single breath count (SBC), Bite to Needle time of ASV, ASV treatment before referral, total dose of anti-snake venom administered and duration of stay were documented. Most important investigation to be performed in vasculotoxic snake bite was 20 WBCT which helps in early detection of coagulopathy and it was done at Baseline on admission and thereafter at six hourly intervals (WHO Regime). In Accelerated Regime, 20WBCT was done at admission and repeated hourly, ASV was exhibited hourly till the blood remained incoagulable guided by the 20 WBCT. Complete blood count with platelets, liver function test, renal function tests, urinalysis to rule out haematuria, coagulation profile (PT, INR) were also done. We analysed the data using student's paired two tailed sample t test. Chi square test was used to compare the variables. A p value of < 0.05 was considered to indicate significant and p<.001 was considered as highly significant.

Results

The present study has thrown interesting statistical facts which can be discussed under the following headings. There were 2 deaths in the WHO regime group (Case Fatality Ratio 2.5)

Age profile

In this study sample, a majority of snake bite victims were aged less than 30 yrs (65%). The demographic profiles of the snake bite victims have been presented in (Table 1).

S.NO	Demographic Parameter	FREQUENCY	PERCENTAGE	TOTAL
1	Age	<30	52 65%	80
		>30	28 35%	
2	Type of Regimen	WHO	60 75%	80
		Accelerated	20 25%	
3	Loc of Bite	Upper limb	48 60%	80
		Lower limb	32 40%	
4	Time of Bite	Day(0600h-1855h)	24 30%	80
		Night(1900h - 0600h)	56 70%	
5	Local signs	Present	58 72.5%	80
		Not present	22 27.5%	
6	Swelling	Present	34 42.5%	80
		Not present	46 57.5%	
7	Neuro Paralysis	Present	8 10%	80
		Not present	72 90%	
9	Platelets at admission	<1 Lac	16 20%	80
		>1 Lac	64 80%	
10	Bite to Needle time	<4 Hrs	54 67.5	80
		>4 Hrs	26 32.5	
11	Total vials of ASV given	<30	46 57.5	80
		>30	34 42.5	
12	ASV Given in MI Room	YES	6 7.5	80
		NO	74 92.5	

Body region

Most of our patients presented with bites on upper extremities (60%) as compared to lower extremities (40%) probably because of protective gear worn by serving personnel such as high ankle DMS boots and anklets. This is in contrast to Lower extremity as being the most common site for snake bite observed in other studies^{11,12,13}

Diurnal variation

In our study, the maximum snakebites occurred between 1900 hrs to 0600 hrs (70%). This is because of poor discernability. Studies

conducted in other parts of the country showed relatively higher incidence of snake bite cases between 6:00 PM and midnight 14 as found in our series.

Complications observed during Hospitalization

The most common complication (Table 2) observed in our study was Sepsis (60%) followed by Cellulitis (30%) and Acute Kidney Injury(AKI, 22.5%)

	Number %hemorrhage			
	Present	2	2.5	80
Intracerebral	Present	78	97.5	80
	Not present	2	2.5	
Acute Lung Injury	Present	12	15	80
	Not present	68	85	
Sepsis	Present	48	60	80
	Not present	32	40	
Compartment syndrome	Present	6	7.5	80
	Not present	74	92.5	
Cellulitis	Present	24	30	80
	Not present	56	70	
Acute Kidney Injury	Present	18	22.5	80
	Not present	62	77.5	

Interval between time of bite and ASV administration (Bite to Needle time)

More than half of the victims (67.5%) were admitted to the hospital within 4 hours of snake bite. A Bite to Needle time more than 4 hrs resulted invariably in complications like Acute Lung injury, AKI, Sepsis etc (100%) as compared to a Bite to Needle time less than 4 hrs which reduced these complications almost by half(55.6%) [p<.001,Highly significant]. The coagulopathy as measured by 20WBCT corrected in less than 8 hrs in 66.7 % cases when the Bite to Needle time was less than 4 hrs, as compared to only 30.8 % when the Bite to Needle time was more than 4 hrs (Table 3)[p< .05 , Significant]

Time	20 WBCT Corrected in		P Value	Chi Square Value	
	< 8 Hrs(%)	>8 Hrs(%)			
TYPE OF REGIMEN	WHO	24 (40)	36(60)	<.001	21.818
	ACCELERATED	20 (100)	0(0)		
Bite To Needle Time	<4 HRS	36(66.7)	18(33.3)	.003	9.138
	>4 HRS	8(30.8)	18(69.2)		
ASV Given in MI Room	YES	6(100)	0(0)	.021	5.307
	NO	38(51.4)	36(48.6)		
Immobilization done	YES	34(70.8)	14(29.2)	<.001	12.155
	NO	10(31.2)	22(68.8)		

First Aid practices at peripheral Medical inspection Room (MI Room)

Effective immobilization at peripheral MI Rooms lead to early (in less than 8 hrs) correction of coagulopathy in 70.8 % cases (Table 3) [p<.001]. ASV was given to 6 patients at peripheral MI Rooms and it lead to correction of coagulopathy in less than 8 hrs in all cases(100%)

Accelerated Regime versus WHO Regime

The Accelerated regime fared better in our study as compared to the WHO Regime in terms of no mortality, correction of coagulopathy in less than 8 hrs (100% cases,

p<.001), lesser complications and short duration of hospitalization. (Table 4)

		Type of Regime		P VALUE	CHI SQUARE VALUE
		WHO Regime N (%)	Accelerated Regime N (%)		
20 WBCT Corrected after	< 8 hrs	24(40)	20(100)	<.001	21.818
	>8 hrs	36(60)	0(0)		
INR Corrected after	< 8 hrs	2(3.3)	20(100)	<.001	70.303
	>8hrs	58(96.7)	0(0)		
Complications	Present	44(73.3)	12(60)	0.26	1.270
	Not present	16(26.7)	8(40)		
Duration of Hospital stay	3 days	34(56.7)	16(80)	.062	3.484
	>3days	26(43.3)	4(20)		

Discussion

Snakes have mystified humans since time immemorial. The first antivenom was developed in 1895 by French physician Albert Calmette for the treatment of Indian Cobra bites. We studied 80 patients in this study who presented with history of snake bite and signs of envenomation.

In the present study, most of snake bite patients were young males comprising of 65% which is in corroboration with previous studies¹⁵. Individuals in this age group are actively involved in soldiering duties, farming and outdoor activity and thus vulnerable to this occupational hazard.

In hospital-based studies, mortality rates ranged around 3% in a north India study by Sharma et al¹⁶. The Case Fatality Rate in our study was 2.5% which was in accordance with previous studies.

The most common complications encountered in our study was Sepsis (60%) followed by Cellulitis (30%) and AKI (22.5%). Bhat RN et al.¹⁷ and Saini et al.¹⁸ in their study recorded Bleeding tendency in 65% and 47.80% respectively. In a study by Nagnath R et al in Central India¹⁹, most of vasculotoxic bites were associated with cellulitis (90.60%) and coagulopathy (19%). Neuroparalysis was encountered in 19.20% cases. In our study neuroparalysis was noted in 10% cases requiring mechanical ventilator support. The incidence of AKI was 14.4% and 43.3 % in studies by Halesha BR et al²⁰ and Nagnath R et al respectively. These differences in the complications found in different studies imply differences between the venoms of the sub species unique to that geographic area.

The importance of Bite to Needle time is a significant factor influencing mortality. A study from Nepal showed that the delay in receiving treatment was significantly longer for victims with a fatal outcome²¹. The optimum time for administration of ASV has been

previously suggested as "as soon as possible" or within 6 hours. Correlation between door to needle time and mortality is similar to those observed by Kavitha Saravu et al²² and IF Inamdar et al²³. In the study by Nagnath et al mortality was high (66.7%) in patients with bite to needle time more than 24 hours, as compared to patients whose bite to needle time was less than 24 hours and lowest when the bite to needle time was less than 6 hrs (7.2%). In our study, bite to needle less than 4 hrs was associated with lesser complications (55.6% vs 100%) and faster resolution of coagulopathy (66.7% vs 30.8%) which was highly statistically significant. The bite to needle time was more than 4 hrs in both the deaths in our study. In both these cases, the coagulopathy had corrected but ASV couldn't prevent VICC leading to hazardous consequences.

These 2 deaths prompted us to devise a region specific ASV protocol for management of vasculotoxic snakebites in our centre. This Accelerated regime has so far stood the test of time in our centre.

The chief limitation of our study is that it is based on prospective analysis of a small number of cases (n=80) in a zonal hospital. It is imperative to carry out a larger clinical study prospectively to obviate inadequacies in the management of snakebite and study the effectiveness of Accelerated Regime vis a vis the WHO regime of ASV administration and replicate the results throughout AFMS. Until then, effective immobilization and expeditious transport of snake bite victims to the hospital, with the swift administration of ASV with a target Bite to Needle time less than 4 hours, will go a long way to prevent mortalities associated with snake bites.

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