



## RESEARCH ARTICLE

### DEMOGRAPHIC PROFILE AND PROGNOSTIC VALUE OF NEUTROPHILIC LYMPHOCYTIC RATIO IN SNAKE BITE PATIENTS

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#### ABSTRACT

**Background:** Snakebite is a major public health problem throughout the world and more so in tropical and subtropical countries, where people are more engaged in agriculture work have highest incidences of snake bites. The neutrophilic/lymphocytic ratio (NLR) is one of the valuable test which may be altered in acute infection, acute stress, acute inflammation and hypovolemic shock.

**Methodology:** This was a descriptive case control study which was carried out over all the patients of snake bite admitted to medical wards of Maharana Bhupal Government Hospital, R.N.T. Medical College, Udaipur (Rajasthan) between the period from January 2019 to November 2019. **Result:** Maximum incidence of snake bite was found in male (62%), from rural area(78%) with farmers (38%) by occupation. It was observed that bite was common in monsoon and post monsoon season (88%), bite was common in lower extremities (56%) and at night time (60%). Among all bite 40% was contributed by non poisonious and rest 60% was poisonious bite , out of which haemorrhagic and neuroparalytic both contributed equally. NLR is found to be normal (<3) in 20% of the snake bite patient while 80% have raise NLR (40% patient have 3-10 followed by 22% patient have 11-20 followed by 12% patient have 21-40). **Conclusion:** NLR was significantly high in snake bite patient both hemorrhagic and neuro-paralytic. NLR is having strong association with lag period, hospital stay, severity and outcome.

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#### INTRODUCTION

Snakebite is a major public health problem throughout the world and more so in tropical and subtropical countries. Worldwide snake bite occurs most frequently in the summer and rainy season when snakes are active, remains outside more and humans being also have more outdoor activities. Tropical and subtropical region where people are more engaged in agriculture work have highest incidences of snake bites than anywhere else. With rapid urbanization and deforestation, the incidence of snake bite are increasing and contributes a significant numbers of hospital admissions. There are no accurate data available which can determine the exact epidemiological and mortality profile in snakebite cases as the true incidence of snakebites is difficult to assess and often is underreported. Despite of such a under reporting, current available data suggest that 4.5 to 5.4 million people are beaten by snake in a year out of which 1.8 to 2.7 million people

develop clinical illness and death range from 80000 to 138000 people per year worldwide<sup>1</sup>. The mortality is lowest in Europe, Australia and North America where as highest in sub- Saharan Africa, South Asia and South East Asia. In India, there are around 2.0 million snake bite reported annually, out of which 35000 to 50000 peoples of snake bite die every year<sup>2</sup>. Worldwide around 3600 species of snake are identified, out of which 216 species of snake were seen in India predominantly<sup>3</sup>. Maximum of snake bite are non-poisonous in nature. The poisonous snake bite can be classified according to there clinical presentation such as hemorrhagic manifestation (hemotoxic), which include bite from viperidae family (Russel Viper, gaboon viper, saw scaled viper), neurological manifestation (neurotoxic) which include bite from elapidae family snakes (Cobras, kraits, mambas, tiger snake) and renal manifestation (nephrotoxic) which includes bite from hydrophidae family snakes. Worldwide among the poisonous bite most common is viper bite where most dangerous bite is by common krait<sup>4</sup> . The overall mortality rates for victims of venomous snakebites are low in regions where medical facility including antivenom are available and rapidly accessed.

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Snake bite is one of the most life-threatening bio-weapon system in the nature which may cause local to systemic complication in the form of neurotoxicity, haematotoxicity or both. There are no reliable diagnostic markers available in clinical practice by which we can assess severity and outcome in snake bite patients. Recent report suggest that so many parameters changes with acute inflammation which include mean platelet volume (MPV), neutrophilic lymphocytic ratio (NLR), PLR and Platelet counts (PC). Neutrophils are the first inflammatory cells which respond to inflammatory process, though they are short lived, their production is increased in bone marrow, joining the circulation in about 1 hr and then they move towards the site of the inflammation. In addition to this neutrophilic response progressive anaemia, leucocytosis, thrombocytopenia, hypofibrinogenemia, proteinuria and azotemia may occurs in snake bite patients. The prognosis and outcome in snake bite patients depend on age, gender, site of bite, type of snake and severity of bite but yet have not proved value. There are no biochemical, cytochemical parameters which can be used for prognostification in snake bite patients. The neutrophilic/lymphocytic ratio (NLR) is one of the valuable test which may be altered in so many condition like acute infection, acute stress, acute inflammation and hypovolemic shock. There were very few study available regarding relation between NLR and snake bite, hospital stay, severity and outcome. With this background that snake bite is acute inflammatory condition which may affect NLR.

**Aim:** To evaluate demographic profile and NLR in snake bite patients and to establish any role of NLR in hospital stay, severity and outcome of patients.

## MATERIALS AND METHODS

This descriptive case control study which was carried out over all the snake bite patients admitted to various medical wards of Maharana Bhupal Government Hospital, R.N.T. Medical College, Udaipur (Rajasthan) between the period from January 2019 to November 2019.

**Inclusion criteria** – 50 healthy age and gender match individual were enrolled as control groups and first 50 patients with a history of snake bite were included in this study as case groups after an informed written consent.

### Evidence of bite by snake included:

- Fang marks,
- Swelling, ecchymosis, blister formation and/or bleeding from local site,
- Disturbances in coagulation mechanism with or without systemic bleeding, and
- Identification of snake wherever possible.
- Neurotoxicity was defined as documented ptosis, external ophthalmoplegia, weakness of neck or bulbar muscles, use of neostigmine or ventilatory support (endotracheal intubation, Ambu bag or a mechanical ventilator).

### Exclusion criteria

- Patients with chronic disorders like anaemia or other hematological disease.
- Patients with acute bacterial infection.
- Patients who did not see the snake and did not have bite marks.

All these admitted patients of snake bite were evaluated in the form of their demographic profile and epidemiological parameters such as age, sex, residence, occupation, followed by detailed history regarding site of bite, time of bite, duration of hospital stay, lag period (patient after bite reaches to hospital) and sign of hemorrhagic/neuroparalytic were recorded. Neutrophilic lymphocytic ratio of all these patients were recorded at time of admission and then divided into to various groups like poisonous, non poisonous and poisonous group again subdivided into hemorrhagic and neuroparalytic group. All these patients were followed up and meticulously recorded any complication occurred during hospital stay and outcome were noted in form of discharge and death. 50 healthy age and sex matched individuals without history of snake bite were enrolled as control groups and NLR were recorded and then mean NLR were compared with both poisonous and non poisonous bite. Contingency table analysis and Independent sample 't'-test were the statical method used in present study.

## RESULTS

In the present study, 50 patients of snake bite were studied. Maximum incidence of snake bite was found in age groups 21 to 30 years of age(30%), males (62%) were bitten more than females (38%). snake bite were observed more common in rural population (78%) with farmer by occupation(38%) followed by labours (16%) predominant bite were seen in lower limb (56%) and in night time(60%).

**Table 1. Clinical profile of snake bite**

	Characteristics	Percentage	
1	Age	Less than 30 years	36%
		More than 30 years	64%
2	Gender	Male	62%
		Female	38%
3	Residence	Rural	78%
		Urban	22%
4	Occupation	Farmer	38%
		Labour	16%
		Housewife	28%
		Student	9%
5	Site of bite	Hand	28%
		Foot	56%
		Back	10%
		Neck	6%
6	Time of bite	Day	40%
		Night	60%
7	Type of snake	Nonpoisonous	40%
		Poisonous	Neuroparalytic 30%
			Hemorrhagic 30%
8.	Month of bite	January to June	6 (12%)
		July to November	44(88%)

**Table 2. NLR in case and control**

NLR	Percentage of snake bite	Mean NLR in Case	Mean NLR in Control	P value
<3	20%	12.09+12.96	1.818+0.20	P<0.0001
3-10	40%			
11-20	22%			
21-40	12%			
>40	6%			
Total	100%			

The bite was predominantly poisonous(60%) out of poisonous snake bite hemorrhagic and neuroparalytic bite contributed equally. The bite was mainly seen in monsoon and postmonsoon season and it was 88% from month July to November and maximum bite was seen in month of September (26%). NLR was found normal (<3) in 20% of the snake bite patient while 80% have raised NLR (40% patient have 3-10 followed by 22% patient have 11-20 followed by 12% patient

**Table 3. Association of NLR in Non poisonous and Poisonous snake bite**

Manifestation	No.	NLR	P-value
Non-Poisonous	20	3.27±1.37	P<0.0001
Hemorrhagic	15	13.10±10.15	
Neuro-paralytic	15	22.83±14.97	

**Table 4. Association of NLR with duration of hospital stay**

Duration of hospital stay (Days)	Mean NLR	P-value
<3	3.39±1.39	<0.001
3-6	12.89±6.43	
>6	22.09±15.13	

**Table 5. Association of lag period with outcome**

Lag period(hrs)	Total patients	Outcome		P-value
		Discharge (%)	Death(%)	
<6	31	30(96.7)	1	P<0.032
6-12	11	10(90.9)	1	
13-24	6	4(66.6)	2	
>24	2	1(50)	1	
Total(50)		45(90)	5(10)	

**Table 6. Outcome with NLR**

Type of snake bite	Discharge		Death		P-value
	No. of patients	Mean NLR	No. of patients	Mean NLR	
Total no. of snake bite patient(50)	45	10.44±11.97	5	26.91±12.15	P < 0.001
Neuro-paralytic (15)	12	20.49±5.196	3	22.67±7.56	P<0.55
Hemorrhagic (15)	13	9.42±4.20	2	37.03±8.65	P<0.0001
Non poisonous(20)	20	3.27±1.37	0	0	

have 21-40). Mean NLR in snake bite patients was  $12.09\pm12.96$  and healthy control group  $1.88\pm0.20$  and when compared, it was found statistically significant ( $P < 0.0001$ ). In the present study it was found that 50% patients of non-poisonous snake bite have normal NLR (<3) but rest 50% patients had mild raised NLR (3-10). Whereas NLR was significantly high in poisonous snake bite group and it was between 3 to 20 with mean NLR  $13.10\pm10.15$  in hemorrhagic patients groups and 11 to 40 in neuroparalytic group with mean NLR  $22.83\pm14.97$  and when compared these value it was found statistically significant ( $P < 0.0001$ ). NLR was compared with duration of hospital stay and was observed mean NLR  $3.39\pm1.39$  when stay was less than 3 days,  $12.89\pm6.42$  when stay was between 3 to 6 days and  $22.09\pm15.13$  when stay was more than 6 days and when compared it was found statistically significant ( $P < 0.001$ ). In present study, patient who admitted in hospital within 6 hrs, between 6-12 hrs and more than 24 hrs after snake bite, the discharge rate were found 96.7%, 90.9% and 50%, whereas death rate was 3.225, 9.09% and 50% respectively and when compared it was found statistically non significant ( $P < 0.032$ ). Outcome was recorded in form of death/discharge and out of 50 patients 45 were discharged and 5 patients were died. Out of these 45 patients discharged, 12 patients were from neuroparalytic group, 13 patients were hemorrhagic group and 20 patients were from non poisonous group. Mean NLR in discharged group was  $10.44\pm11.97$  whereas in death group was  $26.91\pm12.15$  and when compared it was found statistically significant ( $P < 0.0001$ ). Outcome was further analysed in neuroparalytic and hemorrhagic sub group and it was found that in neuroparalytic group mean NLR in discharged and death group was  $20.49\pm5.196$ , and  $22.67\pm7.56$  respectively and when compared it was found statistically non significant ( $P < 0.55$ ).

In hemorrhagic group mean NLR in discharged group was  $9.42\pm4.20$  and death group was  $37.03\pm8.65$  and when compared it was found statistically significant ( $P < 0.0001$ ).

## DISCUSSION

The present study was carried out over 50 patients of snake bite who were admitted in various medical wards of Maharana Bhupal Government Hospital, R.N.T. Medical College, Udaipur, from 1st January 2019 to 30<sup>th</sup> November 2019. 50 age and sex match healthy individual were enrolled as control group. In the present study, 56% patients were bitten in the age group of 21-40 years. Similar type of observation were noted by study conducted by Hati et al<sup>5</sup>, and he found 69% of cases in age group 21- 40 years. Ried et al<sup>6</sup> observed similar type of results and it was 50%. As males are more involved in outdoor activities, 62% patients were male victims in present study, Similar result were observed by study done by Reid et al, who reported 72% males. Study conducted by Warrell et al<sup>7</sup> showed the higher incidence of snake bite in farmers closely related with our study. The Rural: Urban ratio was 3.5:1 in our study which was similar to study done by Sharma et al<sup>8</sup> (2005) who found a rural: Urban ratio 4.7:1. Higher incidence of snake bite in rural areas may be due to fact that large number of people working in the field, walking bare foot and their houses build of mud which provide shelters to snake<sup>9,10</sup>. The present study showed the most common site of bite being lower limbs (56%), followed by 26% in upper extremities and 10% on the back. Similar type of result were seen by the study conducted by Saini et al<sup>11</sup> and he explained bare foot walking in the field may be one of the most important factor which contribute higher incidence of bite on lower limb. Regarding diurnal variation the present study showed 60% snake bite occurred at night time.

The study done by Sharma et al. (2005) and Virmani and Dutt<sup>12</sup>, reported similar type result and was 60.6% and 88% respectively. This may be due to the fact during dusk and poor lightening condition where people inadvertently step on the snakes. In the present study maximum numbers of patients were admitted during monsoon and postmonsoon season. 88% bites occurred between July to November. Similar type of result were observed by study done by Naik et al<sup>13</sup>(60.6%). This is because of heavy rains fills holes and burrows with water and snake comes out and encounter human being. The present study done over 50 patients, 40%(20 patients) bite were by non poisonous snakes where rest 60%(30 patients) were from poisonous snake. Out of this poisonous bite 50% (15) was contributed by neuroparalytic and similar by hemorrhagic variety. Similar type of result were reported by study conducted by Kulkarni et al<sup>14</sup> in 1994 over 633 cases. In the present study 62% (31) patients reached to the hospital with in 6 hrs of bite where 4% patients reached after 24hrs. Study conducted by Kulkarni et al found 6.6% patients were admitted with 1 hrs of bite. In the present study when we compare mean NLR in snake bite group with healthy group, it was found statistically significant this may be due fact that snake venom may increase NLR secondary to inflammation. Salciccioli et al<sup>15</sup> in his study observed high mortality in snake bite patients who are having high NLR at the time of admission. Kurt et al<sup>16</sup> also found high NLR in snake bite group as compare to healthy groups. The present study done over 50 patients, 80% (40 patients) had high NLR and when further sub-studied it was found that in poisonous bite (30 patients) all are having high NLR whereas in non poisonous

bite (20 patients) 10 patients found to be high NLR where rest 10 patients have normal NLR. In the present study NLR were significantly high in both hemorrhagic and neuroparalytic group. Study done by Kurt et al<sup>16</sup> and Elbeys et al<sup>17</sup> reported similar result and they found that this high NLR is closely link with complication. In the present study NLR value were found low and was closely related to stay in the hospital with shorter duration of stay. Study done by Bilal Elbeys et al<sup>17</sup> reported similar result. In the present study we compare lag period with outcome, it was found that with increasing lag period death rate were increasing but it was found statistically non significant.

Similar study were conducted by Elawady and Tawfik et al<sup>18</sup> and reported similar type a result. In the present study outcome were reported in relation to NLR and it was found statistically significant in hemorrhagic snake bite group where in neuroparalytic group it was non significant.

## Conclusion

NLR was significantly high in snake bite patient both hemorrhagic and neuro-paralytic. NLR is having strong association with lag period, hospital stay, severity and outcome. Snake bite is one the common life threatening emergency in this part of India and there are no proved prognostic marker which can predict hospital stay, severity and outcome in these patients. From present study we concludes that's snake bite common in male of younger groups from rural population, with agriculture occupation. Common bite was lower limb and hemorrhagic and neuroparalytic contribute equally. NLR were very good prognostic marker which was significantly high and having positive correlation with hospital stay, severity and outcome of these snake bite patients and hence we recommend that NLR should be taken in consideration in all patients of snake bite at the time of hospital admission.

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