

## CLINICAL AND LABORATORY PROFILE OF SNAKE BITE ENVENOMATION: A CROSS-SECTIONAL OBSERVATIONAL STUDY AT A TERTIARY CARE CENTER

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### ABSTRACT

#### BACKGROUND

Snake bites can be deadly if not treated quickly. A study was conducted to identify the clinical and laboratory profile of snake bite envenomation and to assess the risk factors of mortality.

#### MATERIALS AND METHODS

This was a cross-sectional observational study which included all patients with snake bite envenomation admitted to a tertiary care center in Kerala during January 2015 to December 2015. Clinical features, laboratory parameters, complications and outcome of snake bite were studied.

#### RESULTS

A total of 56 patients were admitted with envenomation. Most of the patients (24) were in age group of 30-50 years and 17 patients were above 50 years. Majority of patients were males (58.9%). Among the 56 patients with envenomation, 89.2% (50) of the patients had haemotoxic envenomation and rest (6) of them had neurotoxic bites. Majority of bites were during day time (60.7%). Major symptoms of snake bite envenomation were swelling (62.5%), bleeding from site (30.4%), redness (25%), vomiting (19.6%), abdominal pain (12.5%). Neurotoxic signs of snake bites were ptosis (66.7%), ophthalmoplegia (16.7%) and dysphagia (16.7%). Out of 56 patients, 12% (6) developed anaphylaxis after anti-snake venom (ASV). Dialysis was required in 19.6% and mechanical ventilation required in 7.1% of patients. There were 5 (8.9%) deaths; all of them belonged to haemotoxic envenomation. Oliguria, mechanical ventilation, leukocytosis, the time between bite and treatment-more than 24 hours was associated with poor outcome.

#### CONCLUSION

Haemotoxic envenomation was more common. The time between bite and treatment alters the prognosis. Mortality was observed only in haemotoxic envenomation. Oliguria, leukocytosis and mechanical ventilation were associated with poor outcome.

#### KEYWORDS

Snakebite, Elapidae, Viperidae, Neurotoxicity, Haemotoxicity, Ptosis, Ophthalmoplegia, ASV, Coagulopathy.

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#### BACKGROUND

Snake bites are medical emergencies in many parts of world especially in India. Being a tropical country, snake bites are a major issue to be tackled. These bites can be deadly if not treated quickly. Most snake bites are innocuous. High mortality is reported particularly in South-East Asia. Snake-bite are more frequent in farmers, plantation workers and others, resulting in tens of thousands of deaths each year.<sup>1</sup>

Although actual global burden of snake bite is not known due to lack of standardized reporting and underreporting, evidence suggest that 4.5–5.4 million people a year are

bitten by snakes, that 1.8–2.7 million of them develop clinical illness (envenoming) after snakebite, and that the death toll could range from 81,000 to 138,000. In India alone, it has been estimated that as many as 2.8 million people are bitten by snakes, and 46,900 people die from snakebite every year.<sup>2</sup>

A syndromic approach should be developed for diagnosing the species responsible for snake-bites. There are three families of venomous snakes in South East Asia, namely Elapidae, Viperidae and Colubridae. The major venomous snakes of Elapidae include cobras, king cobra, kraits. The major snakes in Viperidae family include saw scaled viper, Russel viper. Viperidae Bites predominantly cause bleeding and clotting disorders and Elapidae bites predominantly cause neurological manifestations. It can also cause long term morbidity.<sup>3</sup>

Snake envenomations may produce neuroparalytic, haemotoxic and local reactions. In India krait and cobra cause neuroparalytic envenomation, whereas Viperine bites usually cause haemotoxic manifestations.<sup>4</sup>

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Viper bite envenomation are characterized by prominent local and systemic manifestations mainly in the form of coagulation abnormalities. Haemotoxic bite is more common than neuroparalytic bite and the notorious culprit responsible for most such cases is viper.<sup>5</sup> Severe local oedema, active bleeding from fangs marks with rapid development of systemic bleeding with positive 20-minute whole blood clotting test are all suggestive of Russell viper bite.<sup>6</sup> Pit viper bite are typically characterized by intense local reaction without signs of systemic envenomation. Local oedema may raise intracompartmental pressure and lead to gangrene.<sup>7</sup>

As diagnosis and treatment are based on clinical signs and symptoms of envenomation along with identification of the snake, this study was conducted to identify the clinical, laboratory profile of snake bite envenomation and assess the risk factors of mortality.

**MATERIALS AND METHODS**

The present observational study included all patients with snake bite envenomation admitted in Government Medical College Thrissur, between January 2015 and December 2015.

All adult patients admitted with snake bite envenomation were included in the study. Patients aged less than 13 years and snake bite with no signs of envenomation were excluded from the study. After the consent, their age, sex, occupation, place of bite, site of bite and species of snake if identified were recorded. They were asked about the time of bite, hospital arrival after bite and first aid received. Indications of ASV were noted. They were followed up till discharge or death.

Whole blood clotting time at different intervals, routine blood investigations such as complete blood count, renal function test and liver function test were measured. Those who needed dialysis and mechanical ventilation were noted. All patients were followed up and outcomes were noted.

Whole blood clotting was performed using 2 ml blood and more than 20 minutes of clotting was considered as a sign of envenomation. Acute kidney injury (AKI) was defined as an acute rise in serum creatinine 0.3 g/dL in patients with normal renal function within 2 days or rise in serum creatinine more than 1.5 times the baseline within 7 days or decrease in urine output of more than 0.5 ml/kg/hr for more than six hours or the need of acute haemodialysis.

Quantitative variables were reported as mean ± SD and the qualitative variables as percentage. The Chi square test was used for qualitative variables. Statistical relation is expressed as ODDS ratio with P value.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Frequency	9	1	4	3	7	5	2	8	5	3	2	7
Percentage	16.1	1.8	7.1	5.4	12.5	8.9	3.6	14.3	8.9	5.4	3.6	12.5

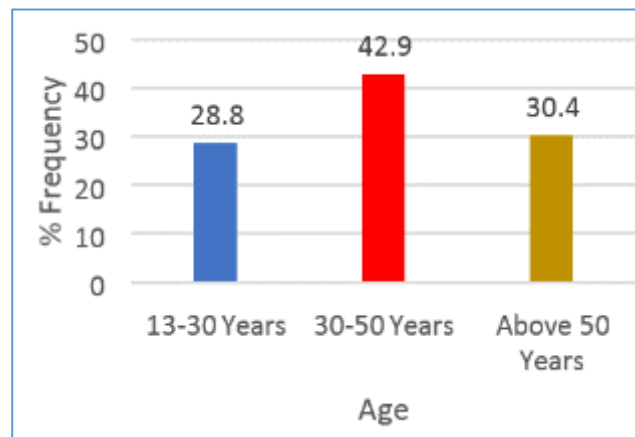
**Table 2. Month-wise Distribution of Snake Bite**

In 34 (60.7%) patients, snake bite happened during day time and during evening and night in 22 (39.3%) patients. Among the venomous bites, 43 (76.7%) patients had

Informed consent was taken from all patient or his/her legally valid immediate relative. There were no major ethical issues involved as no invasive procedures were done on the patient as a part of this study alone.

**RESULTS**

Out of 96 cases of snake bites reported, 56 patients had poisonous snake bite and they were included in the study. Most of the patients (24 cases, 42.9%) were in age group of 30-50 years followed by 15 (26.8%) patients were in the age group of 13-30 years (Figure 1). Majority of snake bite were found in male (58.9% vs. 41.1% in women).



**Figure 1. Age-wise Distribution of Snake Bite**

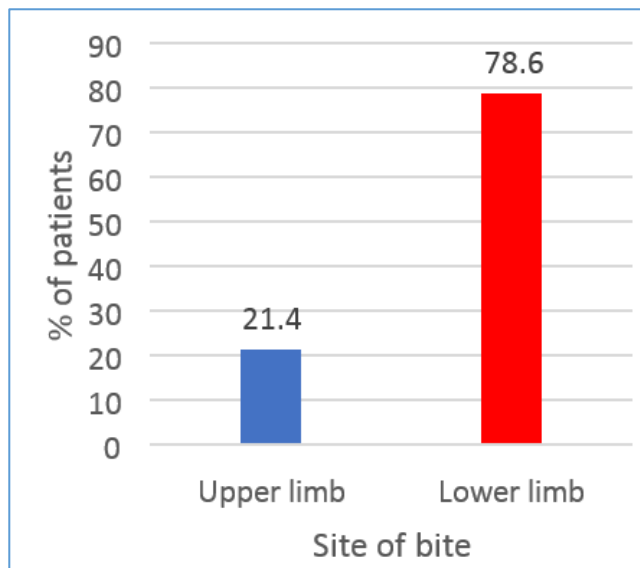
Among 56 patients, 35 (62.5%) patients were manual labours and 16 (28.6%) were house wives. Out of 56 patients with envenomation, 50 (89.2%) were having haemotoxic and 6 (10.7%) having neurotoxic features. Snake was not identified in 45 cases (80.4%) followed by snake bite by viper 10 patients (17.9%, Table 1).

	No. of Patients	Percentage
Krait	1	1.8
Viper	10	17.9
Unknown	45	80.3
Total	56	100

**Table 1. Types of Snake**

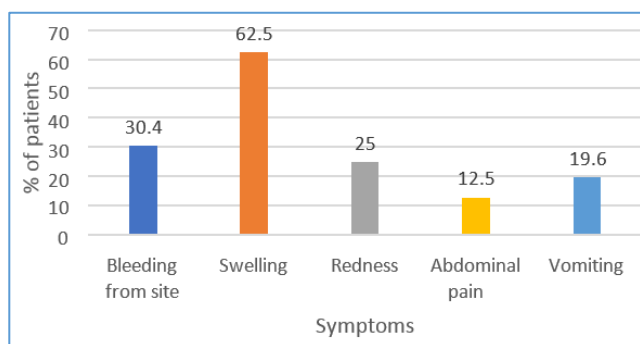
In 42 (75%) patients, snake bite happened in and around the house and rest 14 (25%) were in work place. Maximum poisonous bites were during the months of December and January (28.6%) followed by august and September (23.2%, Table 2).

received first aid. Bites occurred on the lower limbs in 44 (78.5%) patients and on the upper limb in 12 (21.4%) of patients, (Figure 2).



**Figure 2. Site of Bite**

Out of 56 patients, 41 (73.2%) patients were brought to causality within 6 hours, 10 (17.9%) patients between 6 hrs to 24 hrs and 5 (8.9%) patients were brought after more than 24 hrs. Swelling was the most common symptom of snake bite envenomation followed by bleeding from site (Figure 3).



**Figure 3. Symptoms at Presentation**

The main findings upon examination included local rise in temperature local tenderness, lymph node enlargement, swelling crossing proximal joint, compartmental syndrome, cellulitis, and necrosis in decreased order as shown in table 3.

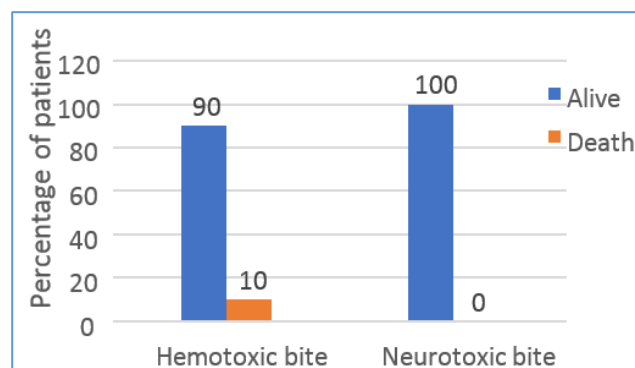
Bite Reactions	No. of Patients	Percentage
Local rise in temperature	26	46.4
Local tenderness	24	42.9
Lymph node enlargement	21	37.5
Swelling crossing proximal joint	18	32.1
Compartmental syndrome	1	5.4
Cellulitis	2	3.6
Necrosis	3	1.8

**Table 3. Bite Site Reactions Findings During Examination**

Various neurotoxic signs were ptosis in 66.7% of patients, ophthalmoplegia in 16.7% and dysphagia in 16.7%.

Out of 56 patients, 14(25%) patients developed acute kidney injury (AKI). Among these patients, 11(78.5%) patients required haemodialysis and 4(7.1%) patients required mechanical ventilation. Anaphylaxis due to ASV administration developed in 6(12%) patients.

Mortality rate in patients with snake bite envenomation was 8.9% (5 out of 56) (Figure 4). All the mortality cases were due to haemotoxic envenomation.



**Figure 4. Outcomes After Snake Bite**

Death occurred in 2 out of 5 patients who arrived after 24 hours and in 3 out of 51 patients who arrived less than 24 hours (Table 4). Higher mortality was observed in those who arrived to the hospital after 24 hrs of bite.

Time of Arrival	Death	Alive	Total
>24 hours	2	3	5
<24 hours	3	48	51
Total	5	51	56

**Table 4. Time of Arrival After Snake Bite and Outcomes**

Urine output reduced in 10 patients; out of which 3 died (Table 5). Oliguria in patients was associated with high mortality.

Urine Output	Death	Alive	Total
Decreased	3	7	10
Normal	2	44	46
Total	5	51	56

**Table 5. Oliguria and Outcomes After Snake Bite**

Death occurred in 3 out of 4 patients who were ventilated compared to 2 out of 52 in non-ventilated patients (Table 6).

	Death	Alive	Total
Ventilated	3	1	4
Not ventilated	2	50	52
Total	5	51	56

**Table 6. Mechanical Ventilation and Outcomes After Snake Bite**

Death occurred in 3 out of 10 patients with leucocytosis at presentation compared to 2 out of 46 patients without leucocytes.

## DISCUSSION

In India, around 2.8 million people are bitten by snakes, and 46,900 people die from snakebite every year.<sup>2</sup> Quick transportation of the victim to the nearest medical facility and prompt administration of sufficient quantities of the appropriate antivenin helps to save lives.<sup>3</sup> In the present study, 56 patients with envenomation were studied. Most of the patients (42.9% of patients) were in age group of 30-50 yrs and majority of the patients (58.9% of patients) were males. These results are similar to the observations in a study conducted by Palappallil DS et al., in which the mean age was  $37.58 \pm 14.54$  years and 51.1% were males.<sup>8</sup> In another study conducted by Ahuja MM as early as 1954, the ratio of male; female victims of snake bite was 4:1.<sup>9</sup> A study by Bhat et al. in 1974, the incidence ratio was 7:3 (M:F).<sup>10</sup>

Farmers are most commonly bitten by snakes. In the present study, among 56 patients, 62.5% of patients were manual labourer and 28.6% were house wives. In a similar study conducted in Maharashtra, 122 farmers, 13 students, 14 housewives, and 1 snake charmer had snake bite.<sup>11</sup> Many other studies conducted by Bhat et al., Saini et al., and Sarangi et al., reported that snake bites in farmers to be 75%, 78%, and 72%, respectively.<sup>10,12,13</sup> In a recent study conducted in Andhra Pradesh, majority (72 (82.8%)) were farmers.<sup>14</sup>

Haemotoxic snake bites are common in India. Results of present study suggest that 89.2% had haemotoxic and 10.7% had neurotoxic features. The Mean dose of ASV administered was 14.6 vials for haemotoxic and 17.5 vials for neurotoxic. A study by Pore SM et al, suggest vasculotoxic snake bite as the main indications for ASV administration (75%) followed by neurotoxic (16%) and mean dose of ASV was  $18.63 \pm 14.52$  vials.<sup>15</sup>

The present study found that maximum poisonous bites were during the months of December and January (28.6%) and another peak during august and September (23.2%). An epidemiological study of snake bite conducted in south 24 Parganas district of West Bengal found that nearly 65.7% of the snake bite deaths were due to common krait bite, most of them occurring in the months of June to September.<sup>16</sup>

In the present study, majority of bites were during day time 34 (60.7%). This is in contrast to a study by Bhalla et al., where maximum number of snake bites were reported between 4.00 PM to 8.00 PM. Next on the list was between 8.00 PM to 6.00 AM where number of patients bitten was 41.<sup>11</sup> Another study by Virmani and Dutt noted 12% cases during day time.<sup>17</sup>

In the present study, 73.2% of patients were brought to causality within 6 hours, 17.9% between 6 hrs to 24 hrs 10 and 8.9% more than 24 hrs 5. Pulimaddi R found similar trend in reporting to hospital where 86 out of 100 patients arrived in the hospital within 24h, and 14 arrived after 24h.<sup>18</sup>

The main examination findings in the present study were local rise in temperature, local tenderness, lymph node

enlargement, swelling crossing proximal joint, compartmental syndrome, cellulitis and necrosis. Various neurotoxic signs were ptosis, ophthalmoplegia and dysphagia. In the study by Pulimaddi, major symptoms of snake bite envenomation were swelling 62.5%, bleeding from site 30.4%, redness 25%, vomiting 19.6% and abdominal pain 12.5%. Oliguria was found in 60, bleeding tendencies in 64, haemodynamic instability (tachycardia) in 86. Systolic blood pressure (BP) was  $<120$  mm Hg in 68 and BP was not recordable in four patients.<sup>18</sup>

In the present study, 14 out of 56 patients (25%) developed AKI and 11 out of 14 patients (78.5%) who had AKI required haemodialysis. These results were similar to the results reported by Jayakrishnanan M P et al which showed occurrence of AKI in 25% patients.<sup>19</sup> In the study by Pullimaddi et al, 12 patients were in stage III kidney disease and needed haemodialysis. Of the 100 cases of snakebite-induced acute kidney failure, 86 recovered and six died. On follow up, after six months eight patients developed chronic kidney failure.<sup>18</sup>

Mortality is mainly due to haemotoxic envenomation. Hospital arrival after 24 hrs of bite, oliguria, mechanical ventilation and presence of leucocytosis at presentation were also associated with higher mortality. A recent analysis of 1, 500 cases from a tertiary care center in North Kerala capillary leak syndrome (CLS) in haemotoxic snake bites was the major cause of death (80%). Albuminuria, neutrophilic leucocytosis, thrombocytopenia, AKI, and early onset of symptoms were associated with poor outcome.<sup>20</sup>

There is a huge gap in the actual number of snake bites and snake bites officially reported in India. Only 22.19% of the snake bite victims attended the hospitals. Lack of awareness, delayed presentation to the hospital, and treatment by nonmedical personnel also add to the risk of mortality.<sup>16</sup>

## CONCLUSION

Haemotoxic envenomation was more common than neurotoxic envenomation. More males were affected and majority of them were manual labourer. In this study, 20-minute whole blood clotting time was elevated in majority of the patients. AKI was found in one fourth of patients. Mortality was seen only in haemotoxic envenomation. Time of bite and treatment gap of more than 24 hours was associated with poor outcome. Patients who required mechanical ventilation were at higher risk of mortality. Oliguria and presence of leukocytosis at presentation were associated with poor outcome.

## REFERENCES

- [1] 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):118-123.
- [2] Prevalence of snakebite envenoming. WHO. Available at: <http://www.who.int/snakebites/epidemiology/en/>.
- [3] Warrell DA. Guidelines for the management of snake-bites. World Health Organization 2010.

- [4] Law AD, Agrawal AK, Bhalla A. Indian common krait envenomation presenting as coma and hypertension: a case report and literature review. *J Emerg Trauma Shock* 2014;7(2):126-128.
- [5] Monteiro FN, Kanchan T, Bhagavath P, et al. Clinico-epidemiological features of viper bite envenomation: a study from Manipal, South India. *Singapore Med J* 2012;53(3):203-207.
- [6] Bawaskar HS, Bawaskar PH, Punde DP, et al. Profile of snakebite envenoming in rural Maharashtra, India. *J Assoc Physicians India* 2008;56:88-95.
- [7] Glass TG. Early debridement in pit viper bites. *JAMA* 1976;235(23k0):2513-2516.
- [8] Palappallil DS. Pattern of use of antibiotics following snake bite in a tertiary care hospital. *J Clin Diagn Res* 2015;9(8):OC05-OC09.
- [9] Ahuja MM. Progress in clinical medicine in India. Second Series 1978:136-177.
- [10] Bhat RN. Viperine snake poisoning in Jammu. *J Indian Med Assoc* 1974;63(12):383-392.
- [11] Bhalla G, Mhaskar D, Agarwal A. A study of clinical profile of snake bite at a tertiary care centre. *Toxicol Int* 2014;21(2):203-208.
- [12] Saini RK, Sharma S, Singh S, et al. Snake bite poisoning: a preliminary report. *J Assoc Physicians India* 1984;32(2):195-197.
- [13] Sarangi A, Jana I, Das JP. Clinical profile of snake bite poisoning. *J Assoc Physicians India* 1977;25:55-60.
- [14] Kumar MR, Veeraprasad M, Babu PR, et al. A retrospective review of snake bite victims admitted in a tertiary level teaching institute. *Ann Afr Med* 2014;13(2):76-80.
- [15] Pore SM, Ramanand SJ, Patil PT, 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):270-274.
- [16] Majumder D, Sinha A, Bhattacharya SK, et al. Epidemiological profile of snake bite in south 24 Parganas district of West Bengal with focus on underreporting of snake bite deaths. *Indian J Public Health* 2014;58(1):17-21.
- [17] Virmani SK, Dutt OP. A profile of snake bite poisoning in Jammu region. *J Indian Med Assoc* 1987;85(5):132-134.
- [18] Pulimaddi R, Parveda AR, Brahmanpally B, et al. Incidence & prognosis of acute kidney injury in individuals of snakebite in a tertiary care hospital in India. *Indian J Med Res* 2017;146(6):754-758.
- [19] Jayakrishnan MP, Geeta MG, Krishnakumar P, et al. Snake bite mortality in children: beyond bite to needle time. *Archives of Disease in Childhood* 2016;102(5):445-449.
- [20] Kumar KS, Narayanan S, Udayabhaskaran V, et al. Clinical and epidemiologic profile and predictors of outcome of poisonous snake bites - an analysis of 1,500 cases from a tertiary care center in Malabar, North Kerala, India. *Int J Gen Med* 2018;11:209-216.