

# Bite-to-needle Time – An Extrapolative Indicator of Repercussion in Patients with Snakebite

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## ABSTRACT

**Background:** Snakebite is a significant occupational and environmental hazard in tropical countries. The treatment of snakebite includes care of the wound, supportive care, and administration of anti-snake venom (ASV). Time is crucial to reducing the morbidity and mortality of patients. This study aimed to assess the “bite-to-needle time” with morbidity and mortality of snakebites and correlate it.

**Patients and methods:** A total of 100 patients were included. Detailed history included the time since snakebite, bite site, species of snake, and symptoms at presentation, which included level of consciousness, cellulitis, ptosis, respiratory failure, oliguria, and bleeding manifestations. “Bite-to-needle time” was noted. Polyvalent ASV was administered in all patients. Duration of hospitalization and complications, including mortality were noted.

**Results:** The age-group of the study population was 20–60 years. About 68% were males. Krait was the commonest species (40%), and the lower limb was the commonest bite site. Within 6 hours, 36% of patients received ASV, and between 6 and 12 hours, 30%. Patients with a bite-to-needle time of under 6 hours spent less time in the hospital and experienced fewer complications. Patients with bite-to-needle times longer than 24 hours had more ASV vials, complications, hospital-stay length, and death.

**Conclusion:** An increase in bite-to-needle time increases the chances of systemic envenomation, hence, the severity of complications or morbidity and risk of mortality increases. The necessity of timing and the value of administering ASV on time must be emphasized to the patients.

**Keywords:** Antisnake venom, Bite-to-needle time, Complications, Mortality, Snakebite.

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## HIGHLIGHTS

- Increase in bite-to-needle time increases the chances of systemic envenomation.
- Severity of complications or morbidity and risk of mortality increases in proportion to the bite-to-needle time.
- Administering ASV on time must be emphasized to the patients.

## INTRODUCTION

In tropical nations, snakebite is a substantial occupational and environmental hazard, and death due to a snakebite is common. The estimated death due to snakebites in India has been found to be close to 58,000/year, and on average, the risk of an Indian dying of snakebite before 70 years is 1 in 250.<sup>1</sup> Most of these deaths were reported in the age-group of 20–39 years.<sup>1–3</sup> Widespread bleeding, muscular paralysis, and tissue necrosis at the bite site are all possible fatal outcomes of snakebite.<sup>4</sup> Snakebite can cause permanent disability as a result of amputation or blindness.<sup>5</sup> There can be long-term effects of snakebites, such as acute kidney injury leading to renal failure.<sup>6</sup>

The treatment of snakebite includes care of the wound, supportive care, and administration of ASV at the earliest to neutralize the snake venom.<sup>7</sup> Though we are competent enough to manage these cases with sufficient ASV availability, we cannot prevent the deaths due to snakebites. The delay in receiving treatment in countries like India is due to the under-reporting of snakebite cases, the use of traditional treatments, and the lack of access to healthcare facilities.<sup>8</sup> The treatment of snakebites with native remedies like the application of a tourniquet, incision,

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application of herbal medicine, and suction of the venom from the bite site are some of the “bizarre practices” followed in India.<sup>2</sup> This further delays patients from seeking treatment from a proper health care facility. The delay in the patients receiving the ASV is a critical determinant of the complications and mortality of snakebites. This time is crucial to reduce the morbidity and mortality of the patients. There are various studies on trends in snakebite mortality and morbidity, conversely, there is a need to assess the mortality and morbidity due to delay in treatment. This study is intended to assess the “bite-to-needle time” with morbidity and mortality of snakebites and correlate it.

## PATIENTS AND METHODS

The study was commenced after obtaining the Institute Ethics Committee approval dated 23/04/2016; all patients admitted with a history of snakebites from July 2016 to June 2017 were included in the study. After obtaining the written informed consent from the patient, a total of 100 patients were included. A detailed history and physical examination were made, and data were collected. A thorough history was taken, detailing the timeline of the snakebite, the bite site, the type of snake, and the symptoms present at the time of the presentation, such as level of consciousness, pain at the bite site, cellulitis, vomiting, abdominal pain, ptosis, respiratory failure, oliguria, and bleeding manifestations. A thorough physical examination of the cardiovascular system, respiratory system, abdomen, and central nervous system was done. Whole blood clotting time (WBCT) was analyzed. Anti-snake venom was administered per the existing institutional protocol. "Bite-to-needle time" was noted. Polyvalent ASV was administered in all patients. The total number of ASV vials administered was noted. All patients were monitored closely for the development of complications until the time of discharge.

The following complications were noted:

**Acute Kidney Injury (AKI):** Serum creatinine >1.5 mg/dL or oliguria <400 mL/day, disseminated intravascular coagulation (DIC), compartmental syndrome, gangrene, cellulitis that required debridement, shock, sepsis, and neurological paralysis requiring ventilatory support.

The study population was divided into four groups depending on the bite-to-needle time. Any correlation between time of ASV administration development of complications, duration of stay, total requirement of ASV, outcome, and WBCT was studied.

### Statistical Analysis

All the data collected were analyzed using SPSS Software version 25 [IBM, United States of (USA)]. Continuous data were represented as mean and standard deviation, and categorical data were represented in frequency and percentages. Chi-square analysis was done to compare the categorical data between the groups. Probability *p*-value less than 0.05 was considered statistically significant.

## RESULTS

The study population comprised patients between the ages of 20 and 60 years, of which 68% were males and 32% were females (Table 1). Krait was the commonest snake species reported for bites (40%), with the lower limb being the commonest site of the bite. The prolonged clotting time was noted in 84% of patients, most received ASV within 12 hours, with 36% within 6 hours, and 30% within 6–12 hours. Anti-snake venom as many as 30 vials was administered in 61% of patients. The duration of hospitalization was less than 10 days for 79% of patients and >10 days for 21% of patients. Cellulitis and acute kidney injury were the commonest symptoms, followed by septic shock, respiratory failure, and DIC. Nine of the 100 patients did not survive (Table 2).

The groups are divided with the bite-to-needle time as the criteria (Table 3):

### Group I: Bite-to-needle time <6 hours

There were 36 patients in this group, and 80% of patients in the group received 20 vials of ASV, and 88.9% of patients had clotting

**Table 1:** Characteristic of the study population

Parameter	Frequency (Percentage) n = 100
Age in years	
<20 years	9
21–30	19
31–40	26
41–50	20
51–60	14
>60	12
Gender	
Male	68
Female	32

**Table 2:** Clinical profile of snakebite among the study population

Parameter	Frequency (Percentage) n = 100
Snake species	
Krait	40
Cobra	12
Viper	30
Unknown	18
Bite site	
Upper limb	37
Lower limb	63
Whole blood clotting time	84
>20 minutes	
Bite-to-needle time	
<6 hours	36
6–12 hours	30
12–24 hours	22
>24 hours	12
Total ASV administration	
10 vials	4
20 vials	35
30 vials	61
Duration of hospitalization	
<5 days	28
5–10 days	51
>10 days	21
Complications/Outcome	
Cellulitis	50
Acute kidney injury	34
Septic shock	12
DIC	10
Respiratory failure	10
Non-survivors	9

ASV, anti-snake venom; DIC, disseminated intravascular coagulation

time >20 minutes. The duration of hospitalization was less than 10 days in this group with minimal complications; only one case of cellulitis and 4 cases of DIC were reported.

**Table 3:** Bite-to-needle time to complications and outcome

Parameter	Group I (n = 36)	Group II (n = 30)	Group III (n = 22)	Group IV (n = 12)	p-value
Anti-snake venom					0.001
10 vials	4 (11.1)	–	–	–	
20 vials	29 (80.6)	4 (13.3)	2 (9.1)	–	
30 vials	3 (8.3)	26 (86.7)	20 (90.9)	12 (100)*	
Whole blood clotting time >20 minutes	32 (88.9)	25 (83.3)	18 (81.8)	9 (75)	0.694
Duration of hospitalization					0.001
<5 days	27 (75)	1 (3.3)	–	–	
5–10 days	9 (25)	20 (66.7)	15 (68.2)	7 (58.3)	
>10 days	–	9 (30)	7 (31.8)	5 (41.7)*	
Cellulitis	1 (2.8)	17 (56.7)	21 (95.5)*	11 (91.7)	0.001
Acute kidney injury	4 (11.1)	8 (26.7)	10 (45.5)	12 (100)*	0.001
DIC	–	–	4 (18.2)	9 (75)*	0.001
Septic shock	–	1 (3.3)	4 (18.2)	7 (58.3)*	0.001
Respiratory failure	–	6 (20)	3 (13.6)	1 (8.3)	0.053
Non-survivors	–	–	1 (4.5)	8 (88.9)*	0.001

DIC, disseminated intravascular coagulation

#### Group II: Bite-to-needle time 6–12 hours

A total of 30 patients were in this group, four of them required 20 vials of ASV and 26 of them required 30 vials, and 83.3% of the patients had prolonged clotting time (>20 minutes). Only 30% of patients required more than 10 days of hospitalization. Cellulitis was the most typical complication, followed by acute kidney injury, respiratory failure, and septic shock.

#### Group III: Bite-to-needle time 12–24 hours

There were 22 patients in this group, and most of them required 20 vials of ASV. Clotting time was prolonged in 81.8% of patients. The duration of hospitalization was >5 days for all patients. Cellulitis (95.5%) and acute kidney injury (45.5%) were the commonest complications. One death was reported in this group.

#### Group IV: Bite-to-needle time >24 hours

All 12 patients in this group required 30 vials of ASV, clotting time was prolonged in 75% of patients. The duration of hospitalization was up to 10 days for 58.3% and >10 days for 41.7% of patients. All of them developed acute kidney injury, and the next commonest complication was cellulitis, followed by septic shock and respiratory failure. Out of the 12 patients, eight deaths were observed.

## DISCUSSION

Snakebite is one of the most commonly occurring accidents in tropical countries like India. Some snakebites are lethal, and timely intervention with ASV saves the life. India is a developing country, availability of ASV at the rural health center and timely intervention is quite tricky. This study correlated the bite-to-needle time with various morbidity, complications, and survival in the individuals. In this study, the most familiar type of snake affecting was Krait, the same observation was made by Halesha et al., Jarwani et al., and many others.<sup>2,9–11</sup> Males were affected more than females, this is because males are mostly the family's breadwinners, and they tend to go out in rural tropical India. The commonest age-group affected

was 31–40 years of age, this was again for the same reason that the earning member of the family usually falls within this age range. The same results were observed by Suchithra et al. and Inamdar et al.<sup>9,11</sup>

In this study, 84% of patients had prolonged clotting time. Whole blood clotting time is one of the essential tests done in all snakebites to diagnose hemotoxic snakebites. Often, the ASV administered after this test is found abnormal. At times, this delays the administration of ASV to the sensitivity of WBC time being low for envenomation.<sup>12,13</sup> However, many argue that ASV administration is not free of adverse reactions and timely detection of signs of envenomation helps to make judicious use of ASV in a country like India where there is a scarcity of ASV.<sup>14</sup> In this study, most (60%) patients received ASV within 6–12 hours. Many other studies have reported ASV institutions within 6–12 hours.<sup>15,16</sup>

The bite-to-needle time is significantly related to the number of vials required as an antidote. Most patients who were brought within 6 hours required a maximum of 20 vials. As the bite-to-needle time increased, the requirement for ASV vials increased. All other groups other than group I required more than 30 vials of ASV. Similar results were observed by Gadwalkar et al., bite-to-needle time of greater than 4 hours required more than 14 vials of ASV.<sup>17</sup> An increase in time to ASV administration caused increased envenomation, hence, an increased amount of ASV was required.

In all the groups, the coagulation time was prolonged in most patients, and we can observe that the coagulation time was prolonged in a progressively decreasing number of patients from group I to group IV. The presence of complications like cellulitis and DIC in group I and AKI, respiratory failure, and even death in group IV supports the theory that this is because group I had a higher percentage of patients with hemotoxic bites while group IV had a higher percentage of neurotoxic bites. Our population had a mixture of all types of snakebites. However, there is no specific explanation for this phenomenon.

The duration of hospitalization increases as the bite-to-needle time increases. Similar results have been observed by Saravu et al. and Ogunfowokan.<sup>18,19</sup> The bite-to-needle time is crucial in

deciding the duration of hospital stay as an increase in a bite-to-needle time leads to more complications and morbidity. This can be observed in this study itself that group I patients developed mainly cellulitis as a complication. As we progress toward group IV, there is acute kidney injury, shock, and respiratory failure. There is a report of AKI and respiratory failure among patients with increased bite-to-needle time.<sup>20</sup> This also supports the finding that more severe complications occur as the bite-to-needle time increases. The number of complications is directly proportional to the time the venom remains in the body before neutralization by ASV.<sup>21</sup> Mortality is observed in groups III and IV, where the bite-to-needle time is >12 hours and >24 hours, respectively. The morbidity and mortality risk increases as the bite-to-needle time gets prolonged and much more if the time is greater than 12 hours like the study done by Saravu et al.<sup>19</sup>

From the above shreds of evidence, we can say that bite-to-needle time dictates the morbidity and mortality of snakebite patients. The amount of ASV required to neutralize increases as the venom gets a long time to be present in the body, and hence chances of systemic envenomation increase. The severity of complications is also due to the same reason. There is a delay in individuals getting to health facilities in a nation like India, where people frequently seek out folk healers. People need to be aware of this period's importance, especially in tropical nations like India, where snakebites are widespread.

## CONCLUSION

An increase in a bite-to-needle time increases the chances of systemic envenomation, hence, the severity of complications, morbidity, and risk of mortality increases. Patients need to be made aware of the value of timing and the significance of delivering ASV on schedule.

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