

A Study of Vascular Complications of Snake Bite in a Tertiary Care Hospital

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ABSTRACT

Introduction: Snake venom contains twenty or more toxins, most of which are enzymes which mainly consist of a mixture of hydrolases which produce various manifestations such as bleeding, dermonecrosis, myonecrosis, inflammation and coagulation disorders. This study was done to assess the vascular complications in patients who presented to the hospital with alleged history of snake bite.

Material and methods: This descriptive study was conducted over 18 months which included 45 patients admitted to the hospital with alleged history of snake bite satisfying the inclusion and exclusion criteria. A detailed history was taken, which was followed by clinical examination and relevant investigations. All the patients received treatment as per protocol. Patients were monitored for any vascular complications and treated accordingly.

Results: Out of the total of 45 patients admitted to the hospital with history of snake bite, 31 patients had vascular complications (68.88%). The mean age of the patients was 34.54 years and with 67.6% being males. Viper bites were the commonest (54.83%) snake bite leading to vascular complications and most of the bites occurred at night (61.29%). Local swelling and oozing was seen in all 31 (100%) patients, which was the most common presenting symptom, all 31 patients also had pain at the site of bite/entire limb, 83.8% had cellulitis, 22.5% had blisters and 12.9% developed necrosis. 10 patients (32.2%) had to undergo fasciotomy. Systemic vascular complications were seen in 14 (45.1%) patients which included bleeding or clotting abnormalities, out of which 50% had visible gum bleeding and 28.57% had haematuria. 3 patients (9.67%) developed hypotension requiring inotropic support and 7 patients (22.58%) developed acute renal failure, out of which 5 of them required renal replacement therapy. 6 (19.35%) required ventilatory support and 3 (9.67%) of them succumbed to the vascular complications of snake bite.

Conclusion: Snake bite is a common life-threatening emergency. Most of the vascular complications were associated with viper bite. Delay in hospitalization and treatment is associated with poor prognosis and increased mortality rate due to various vascular complications such as consumptive coagulopathy, hypotension and renal failure.

Keywords: Snake Bite, Vascular Complications, Vasculotoxic

INTRODUCTION

Snake bite is stated to be a neglected public health issue in many of the tropical and subtropical countries. Snake envenoming is often under-reported and there is limited precise data on the burden of snakebites. The estimates propose that there are 5.5 million bites, 1.8 million envenomings and 94,000 deaths annually due to snakebite,

with the largest burden of snakebite occurring in South Asia, Southeast Asia, Sub-Saharan Africa and Latin America.¹ Snake bite is also an important occupational and rural hazard in India and accounts for almost half the total number of annual deaths in the world. India had 1.2 million snakebite deaths (representing an average of 58,000 per year) from 2000 to 2019 with nearly half of the victims aged 30-69 and over a quarter being children under 15.²

There are more than 2000 species of snakes in the world and about 300 species are found in India out of which 52 are venomous.³ Many of the snakes have dermonecrotic, cytotoxic, myotoxic or haemorrhagic components in their venoms causing various complications and disabilities. Snake venoms are complex substances, mainly comprising of proteins with enzymatic activity, however the lethal complications are usually caused by certain smaller polypeptides.⁴ The secreted proteins are the major components with varied biological activities, most of which are hydrolytic enzymes which help the snake in digestion or to induce metabolic dysfunctions in the prey and/or to kill it.⁵ It has also been noted that the composition of the snake venom varies from one geographic region to the other depending on the presence of a number of local factors and the prey. Other components include lipids, polysaccharides, amino acids, nucleotides, nucleosides, riboflavin, serotonin and histamine. The main targets of these enzymes are cell membranes, vascular wall and blood coagulation cascade.^{6,7} Snake venoms, especially those of Viperidae contain molecules that act on the coagulation, fibrinolytic, complement and kinin system producing effects like local tissue damage, causing edema and ecchymosis, vascular endothelial damage, haemolysis, disseminated intravascular coagulation (DIC) and various systemic effects causing pulmonary, cardiac, renal and neurologic defects.⁴ Venom alters the capillary membrane permeability, causing extravasation of electrolytes, albumin, and red blood cells through vessel walls into the envenomated site. This process

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How to cite this article: Mahendra M, Mujtaba M, Archita R, Madhumathi R. A study of vascular complications of snake bite in a tertiary care hospital. *International Journal of Contemporary Medical Research* 2021;8(1):A1-A4.

DOI: <http://dx.doi.org/10.21276/ijcmr.2021.8.1.4>



may occur in the lungs, myocardium, kidneys, peritoneum, and, rarely, the central nervous system.

The cobra and krait venoms are neurotoxic and cardiotoxic and local effects are more commonly seen in the former. Viper venom is vasculotoxic and has severe necrotizing local effects. The local complications can range from skin and soft tissue injury causing scarring, to deeper muscle, connective tissue, vascular necrosis and gangrene leading to significant loss of the use of the limb or even amputation.² Venom alters the capillary permeability, causing extravasation of electrolytes, proteins and red blood cells through vessel walls into the envenomated site. This process can also occur in the lungs, myocardium, kidneys, peritoneum and central nervous system.

Most of the deaths and grave consequences due to snake bites are preventable by early initiation of anti- snake venom and other supportive treatment. Moreover, identification of the type of snake bite also helps in early institution of treatment and prevention of certain vascular complications. This study was done to assess the various vascular complications in patients who presented to the hospital with alleged history of snake bite and the treatment outcomes.

MATERIAL AND METHODS

After obtaining institutional ethical committee clearance, patients fulfilling the inclusion criteria were selected after obtaining written informed consent. The study was conducted department of general medicine and paediatrics at S. Nijalingappa Medical College and Hanagal Shri Kumareshwar Hospital and Research Centre, Bagalkot, Karnataka. A total of 45 patients presenting to the hospital with alleged history of snake bite was included in the study as per statistical analysis in accordance with the local incidence and prevalence of snake bite. A detailed history regarding the snake bite including the time and site of the bite, type of snake, local effects and systemic manifestations and history of any treatment received from outside was taken. Investigations like complete blood counts, urine routine, urea, creatinine, random blood sugar, urine routine, serum electrolytes, Bleeding Time (BT), Clotting Time (CT), Prothrombin Time (PT), International Normalized Ratio (INR) and electrocardiography (ECG) were done for all patients. Treatment was given as per protocol. Patients with severe local edema and compartment syndrome were subjected to surgical intervention. Investigations were repeated to evaluate the progress after treatment. The complications were recorded and appropriate management was given. Patients were followed up until recovery or death. The patients who recovered were also followed after discharge to look for development of delayed complications.

RESULTS

A total of 31 patients among the 45 (68.88%) patients presenting to the hospital with alleged history of snake bite developed vascular complications, which included both local and systemic complications. Among them, majority of the patients, i.e. 21 patients were males (67.7%) and 32.3%

(10 patients) were females. Mean age group was 34.54 years, majority belonged to age group of 26-45 years (48.38%), followed by 18-25 years (32.2%). 16.12% of the patients belonged to the age group between 46-65 years and the rest (3.22%) above 65 years, as depicted in Figure 1.

21 (67.74%) patients presented to the hospital within 12 hours after the bite and 10 patients (32.3%) after 12 hours following the bite. 17 patients (54.83%) had viper bite, 13 patients (41.9%) had an unidentified bite and one person had a krait bite. Among the patients who developed vascular complications, the most common site of bite was the foot, seen in 23 patients (74.1%), followed by the hand in 7 patients (22.5%) and 1 patient had the site of bite on the neck. Among the snake bites leading to these complications, highest number (19 patients) of the bites occurred at night (61.29%) and 12 patients (38.70%) were bitten during the day. All of the snake bites occurred outside the house like in the farmlands or the backyard. 8 (25.80%) of the 31 patients also had associated co-morbidities, which included diabetes mellitus in 6 of the patients (19.3%), hypertension in 5

Systemic complications	Percentage
Bleeding and clotting abnormalities – Gum bleeding	45.10%
Haematuria	50%
Acute renal failure	28.57%
Hypotension	22.5%

Table-1: Systemic vascular complications of snake bite

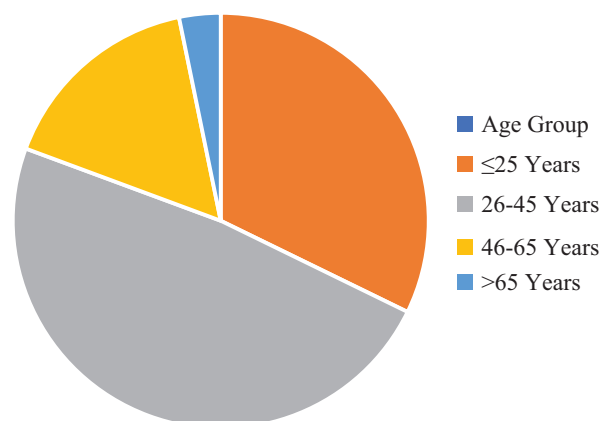


Figure-1: Graphical representation showing age distribution of study population.

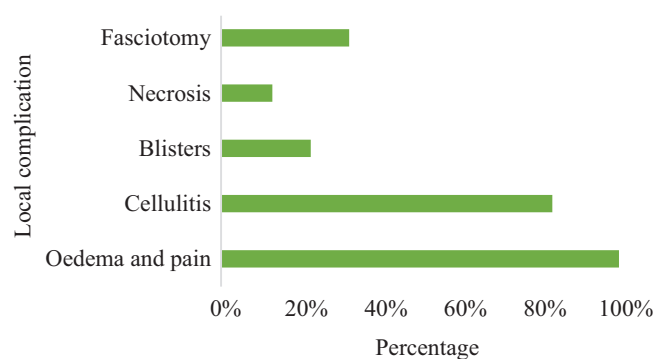


Figure-2: Graphical representation showing the local vascular complications of snake bite

patients (16.12%), ischemic heart disease in 2 (6.45%) and chronic obstructive pulmonary disease in 1 patient (3.22%). The local vascular complications included pain, local oedema, blisters, cellulitis, necrosis, with few of the patients requiring fasciotomy and the systemic complications included hypotension and deranged bleeding and clotting parameters. Local vascular complications were seen in all the 31 patients, among them local oedema and oozing was the most common complication seen in all of the patients. All these patients also had associated pain at the site of bite/entire limb. The other local complications included cellulitis occurring in 26 patients (83.8%), blisters in 7 patients (22.5%) and necrosis in 4 (12.9%) of the patients (Figure 2). Out of these patients, 10 (32.2%) required fasciotomy.

The systemic vascular complications reported were hypotension and deranged bleeding and clotting parameters leading to various bleeding manifestations. Bleeding and clotting abnormalities were seen in 14 (45.1%) of the patients, of which, 7 patients (50%) had visible gum bleeding and 4 patients (28.57%) of them had haematuria, as shown in Table 1.

6 (19.35%) of these patients required treatment and monitoring in the critical care unit. SOFA score was calculated on admission for all admitted in the critical care unit, 5 (83.33%) had increase in the SOFA score from the baseline. All patients received protocol-based management with ASV, blood components and other supportive treatment. ASV requirement in 5 of these patients was 30 vials and 1 patient required 25 vials. 3 of the patients (50%) developed hypotension and all of them were initiated on inotropic support for the same. A total of 7 out of the 31 patients (22.5%) developed acute renal failure and 5 of the patients required haemodialysis.

Mortality rate was among the patients presenting with vascular complications was 9.67% (3 patients). Out of the 3 patients who succumbed to the vascular complications of snake bite, 2 patients were male and 1 was female. All of these patients presented to the hospital beyond 24 hours, 2 of them were bitten by viper and 1 was an unidentified bite. All 3 of them required ventilatory support and required renal replacement therapy.

The mean duration of hospital stay was 6.67 days, with a minimum duration of 3 days and maximum of 10 days. These patients were followed up even after discharge to look for the development of delayed vascular complications. 3 patients (9.67%) developed chronic ulceration in the lower limb, among which one patient had to undergo left below knee amputation.

DISCUSSION

Snake-bite envenoming is an acute life-threatening and neglected tropical and sub-tropical disease primarily affecting the farmers, labourers, hunters and migrant populations in tropical and subtropical countries. In India, 49,000 people die of snake-bite envenoming every year⁸, however, this figure is underestimated because most patients in rural India attend village healers and seek alternative treatment modalities

and these cases go unreported. In India, common venomous snakes include the common krait (*Bungarus caeruleus*), the Indian cobra (*Naja naja*), Russell's viper (*Daboia russelii*), and *Echis carinatus*.⁹ Vasculotoxic complications are most associated with bites of the Viperidae family, leading to severe local swelling, hemorrhagic blisters, local tissue necrosis, incoagulable blood and spontaneous bleeding from various sites and organ systems resulting in multi-organ dysfunction.

In our study population, among the total of 45 patients presenting to the alleged history of snake bite, the mean age group was 34.54 years, with majority of the patients being males (67.6%). Major proportion of the vasculotoxic bites occurred on the lower limbs, especially the foot (74.1%) and occurred at night outside the house in open fields. In a study conducted by Bhalla G et al¹⁰ to evaluate the clinical profile of snake bites in a tertiary care centre in Maharashtra, out of the total of 150 patients studied, 74 patients had non-poisonous snake bites and 76 patients had poisonous snake bites. Similar to our study, males (66%) were bitten more than females (34%) among poisonous bites, with bites more commonly occurring on the lower extremities (88.6%) and during the night (72.66%) in the summer months among the rural population. This was also in accordance to the findings of Ahmed SM et al¹¹ with age range of 20 – 40 years and 53.33% were males, since males are more often involved in outdoor activities.

In this study, 31 among the 45 patients (68.88%) developed vascular complications, out of which 67.74% of the patients presented to the hospital within 12 hours after bite and 32.3% after 12 hours following the bite. 17 patients (54.83%) had viper bite, 13 patients (41.9%) had an unidentified bite and one person had a krait bite. Most of these unidentified bites might have been viper bites leading to the varied vasculotoxic complications. In the study conducted by Bhalla G et al¹⁰, 57.33% patients with alleged history of snake bite presented to the hospital to seek medical help within 6 hours, among which 24.41% were vasculotoxic bites and 18.60% were neurotoxic.

The local vascular complications reported in our study included pain, local oedema, blisters, cellulitis, necrosis with 10 patients requiring fasciotomy and the systemic complications included deranged haemostasis, hypotension and acute renal failure. The most common local vascular complication was local oedema and oozing (100%) associated with pain and the most common systemic vascular complication was deranged bleeding and clotting abnormalities (45.1%). Out of them, 7 (50%) of them had visible gum bleeding and 4 (28.57%) developed haematuria. In the study by Bhalla G et al¹⁰, vasculotoxic snake bites (55.26%) were more common than neuroparalytic bites (27.63%). Commonest vasculotoxic manifestation was local bleeding (83.33%) followed by cellulitis (57.14%). Hematuria (42.85%) was the commonest manifestation in those patients who developed acute renal failure. 2 (4.75%) patients had haemoptysis and 1 (2.3%) patient had epistaxis. Fundal hemorrhage was seen in one patient (2.3%) who

expired within 2 days. Purohit et al¹² in their study in 1944 described gum bleeding as the commonest manifestation of viper bite. Corkill¹³ in the year 1956 described hematuria as the commonest manifestation. The study conducted by Bhat et al¹⁴ in 1974 reported ecchymosis in 43% of patients and haemetemesis was present in 37 patients among 310 patients. 9.67% developed hypotension and were initiated on inotropic support for the same and 22.5% developed acute renal failure in our study. In the study by Bhalla G et al¹⁰, among the 21 vasculotoxic snake bites, 20 of them developed ARF among which 7 required hemodialysis. Four DIC patients received blood transfusion.

Mortality rate was among the patients presenting with vascular complications was 9.67% in our study and all of them presented to the hospital after 12 hours following the alleged history of snake bite. Timely medical attention and treatment could have probably prevented the above deaths. Among four deaths of the 21 vasculotoxic bites in the study by Bhalla G et al¹⁰, three patients died of acute renal failure, and one patient died of DIC and intracerebral hemorrhage. The study done by Reid *et al*¹⁵ in 1981 reported a mortality rate of 2% and majority of the deaths were due to the central nervous system (CNS) involvement.

Delayed vascular complications reported upon follow-up was seen in 9.67% in the form of chronic ulceration in the lower limb, among which one patient had to undergo left below knee amputation in our study. In a study done by Jayawardhana S et al¹⁶, delayed vascular complication of the vascular and musculoskeletal system such as pain, local swelling, muscle weakness, deformities, contractures and amputations were found in 26 (3.2%) and chronic nonhealing ulcer in 1 (0.1%).

CONCLUSION

Snake envenomation is a major public health problem. This study highlights that a significant proportion of snakebite victims suffer from various vasculotoxic complications. Venom toxins result in various devastating effects that are usually encountered during the acute stage of snake envenoming, which either result in death or, with timely medical management can completely resolve after the acute phase. Therefore, most of the complications including acute and delayed, can be prevented by early initiation of standard treatment. There is a need to place systems to address these unmet health needs and institution of various management protocols depending on the geographical region and the most common types of snake bites encountered in the area.

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Source of Support: Nil; **Conflict of Interest:** None

Submitted: 02-11-2020; **Accepted:** 28-12-2020; **Published:** 30-01-2021