MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.36478/makrjms.2024.8.312.317

Demographic and Clinical Insights into Snakebite Treatment: An Analysis of Age, Treatment Modalities and Outcomes

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Abstract

Snakebites are a serious public health concern in rural developing nations, especially India, where they cause high rates of morbidity and mortality. This study, carried out at Shivpuri's SRVS Medical College, examines the demographic traits, clinical presentations and therapeutic results of snakebite cases. Using an observational retrospective methodology, the research examined medical records. Data were collected on a number of factors, including the patient's age, the management that was started prior to hospital admission, the clinical signs of envenomation that were specific, the medical interventions that were used, and the final results of these interventions. Descriptive methods were used to statistically analyse continuous variables like age and length of hospital stay, as well as categorical variables like clinical outcomes and treatment interventions. The study provided important new information about how to treat and handle snakebite cases. The patients were mostly young adults (median age 30 years), with a mean age of 33.05 years. Antivenom serum was used extensively in the treatment protocols, with an average of 21.37 vials per patient. With a mean of 8.5 hours and a median of 7 hours, the post-bite hospital arrival time was noticeably longer than expected, indicating a major delay in receiving care. An average hospital stay was five days long. The presence of neurotoxicity and hematotoxicity had a significant impact on clinical outcomes; cases with neurotoxicity had a mortality rate of 4.9%, which was significantly higher than that of cases without neurotoxic symptoms. The results highlighted the necessity of promptly seeking medical attention and the enhancement of snakebite management procedures to reduce the high risk of severe consequences. To lessen the negative effects of snakebites, stronger healthcare systems, more community education programmes and effective public health initiatives are essential.

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Key Words

Snakebites, epidemiology, antivenom, clinical outcomes, public health, shivpuri, medical intervention

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Received: 25 May 2024
Accepted: 18 June 2024
Published: 23 July 2024

Citation: Divyansh Gupta, Dinesh Singh Mahor and Ritesh Yadav, 2024. Demographic and Clinical Insights into Snakebite Treatment: An Analysis of Age, Treatment Modalities, and Outcomes. Res. J. Med. Sci., 18: 312-317, doi: 10.36478/makrjms.2024.8.312.317

INTRODUCTION

Snakebites pose a significant public health problem, especially in rural areas of developing nations where people come across venomous snakes more often and have limited access to healthcare resources[1]. In India, snakebites are a major problem, causing a lot of sickness and death[2]. The World Health Organisation has acknowledged snakebites as a neglected tropical disease, highlighting the importance of implementing effective management strategies and increasing public awareness[3].

The occurrence of snakebites differs significantly across various regions, influenced by factors like the diversity of snake species, environmental conditions, and human activities. Agricultural workers in various regions of India face increased vulnerability due to the nature of their work, which frequently involves direct exposure to snake habitats[4]. It is essential to have a clear understanding of the demographic patterns of individuals affected by snakebites, such as their age and occupational exposure. This knowledge is vital in order to develop effective prevention and treatment programmes that are specifically tailored to meet the needs of these individuals.

The clinical symptoms of snakebites vary depending on the specific snake species and the characteristics of the venom. Typical signs and symptoms encompass neurological damage, blood toxicity and various systemic impacts, which, if left untreated, can result in serious complications. The administration of antivenom serum (ASV) is the main treatment for venomous snakebites. However, its effectiveness can be affected by various factors, including the time between the bite and treatment, the severity of the bite and any other existing health conditions[5].

Receiving medical help promptly is crucial in determining the outcome of snakebites. Delays in accessing healthcare facilities can worsen the seriousness of envenomation and raise the chances of death. Thus, examining the time it takes to arrive at the hospital and the length of hospital stay offers valuable insights into the efficiency of existing emergency response systems and the overall handling of snakebite incidents[6]. Managing snakebites can be quite challenging because of the different ways they can affect people and the serious problems they can cause, even with antivenom treatment. Having access to extensive information about the demographics, clinical characteristics and treatment results of individuals affected by snakebites is crucial for enhancing clinical guidelines and public health policies[7].

This study seeks to offer a thorough analysis of snakebite incidents that were treated at SRVS Medical College in Shivpuri, Madhya Pradesh. This study aims to analyse the demographic characteristics, clinical presentations, treatment interventions, and outcomes of snakebite patients. The objective was to identify the factors that influence patient prognosis and provide insights for enhancing snakebite management and reducing mortality and morbidity rates.

MATERIALS AND METHODS

This study examined the medical records from SRVS Medical College in Shivpuri, specifically looking at patients who received treatment for snakebites. All patients admitted with a snakebite during this period were considered eligible, except for cases where data was incomplete or missing.

Collecting Data: The data was gathered using a structured form that included:

- **Patient Age:** Recorded to examine any potential relationship between age and snakebite outcomes.
- **First Aid:** Documented to assess the initial care provided prior to hospitalisation.
- **Clinical Manifestations:** Pay close attention to signs of neurotoxicity, hematotoxicity, and any other types of toxicity.

Information was collected on the utilisation of antivenom serum (number of vials), dialysis, blood products and mechanical ventilation in medical interventions.

Time of arrival at the hospital and the length of the hospital stay were documented to examine how they affected the outcomes.

Measured Outcomes: The results were categorised into three groups: death, discharge, or transfer to another medical centre. The study also provided information on the occurrence of different types of toxicities and the need for intensive treatments.

Statistical Data Analysis: We used descriptive statistics to summarise continuous variables, including age, time to hospital arrival and duration of hospitalisation. These statistics, such as the mean, median, and standard deviation, provide a clear picture of the data. Frequency and percentage were used to express categorical variables such as clinical outcomes, toxicity presence, and treatment interventions. This approach helps to provide a clear understanding of the patterns of care and outcomes. This study aimed to explore the various factors that impact the effectiveness of snakebite management and how they affect patient outcomes.

RESULTS AND DISCUSSIONS

The data analysis provides valuable insights into the demographics and clinical characteristics of

Table 1: Demographic and Clinical Characteristics of Snakebite Patients

Variable	Mean	Median	Standard Deviation
AGE	33.05	30.00	13.04
Number of asvvials	21.37	20.00	10.82

Table 2: Distribution of First Aid and Clinical Outcomes in Snakebite Patients

Variable	N	Y
First aid	30	54
Neurotoxicity	64	23
Hematotoxicity	61	26
Any other toxicity	78	3
Dialysis	84	0
Blood products	77	7
Mechanical ventilation	79	5
Outcome (death/discharge)	3/78	-

Table 3: Age-Related Outcomes in Snakebite Incidents

Outcome	Mean Age	Standard Deviation Age
Death	49.00	29.46
Discharge	32.26	11.85
Refer	37.67	18.61

Table 4: Hospital Arrival and Stay Duration for Snakebite Patients

Statistic	Time to Reach Hospital	Duration of Hospitalization
Mean	8.5 hours	5.5 days
Standard Deviation	4.2 hours	2.3 days

Table 5: Outcome Proportions Relative to Toxicity in Snakebite Patients

oxicity Type	Outcome	Percentage With Toxicity (Y)
Neurotoxicity	Death	4.9%
	Discharge	90.8%
	Refer	4.3%
Hematotoxicity	Death	3.8%
	Discharge	88.5%
	Refer	7.7%

individuals affected by snakebites. The average age of the patients was 33.05 years, with a standard deviation of 13.04 years, suggesting that the patient population was relatively young. The average age was 30 years. Regarding treatment, the typical number of ASV vials given was 21.37, with a standard deviation of 10.82 vials. The median number of ASV vials was 20.

The distribution of categorical variables provides valuable insights into the clinical characteristics and outcomes of the patients. Out of all the patients, a majority of 64.3% received first aid, while a significant portion of 26.4% experienced neurotoxicity and 29.9% experienced hematotoxicity.

The age statistics for different outcomes show that the average age of patients who passed away was 49.00 years, with a standard deviation of 29.46 years. This suggests that older patients had a higher likelihood of succumbing to snakebites. On the other hand, the average age of patients who were released was 32.26 years and their age varied by about 11.85 years. In comparison, the average age of patients who were referred was 37.67 years and their age had a wider range of about 18.61 years.

Upon further examination, it was discovered that the average time it took for individuals to arrive at the hospital was 8.5 hours, with a standard deviation of 4.2 hours. The average time it took for patients to arrive at the hospital was 7.0 hours, varying from as little as 1 hour to as long as 20 hours. The average length of hospital stay was 5.5 days, with a variation of 2.3 days. The average length of time was 5.0 days, ranging from 1 day-12 days.

The distribution of results within each category of clinical features offers further understanding of how these features affect patient outcomes. Individuals who experienced neurotoxicity had a mortality rate (4.9%) and a discharge rate (90.8%) compared to those who did not experience neurotoxicity. Patients who experienced hematotoxicity had a slightly higher mortality rate of 3.8% and a discharge rate of 88.5%. All fatalities were observed in patients who had other types of toxicity, resulting in a 100% mortality rate within this group. Conversely, all patients without other types of toxicity were successfully discharged.

The objective of this study was to examine the various aspects of snakebite incidents treated at SRVS Medical College, Shivpuri. This included analyzing the demographic characteristics, clinical symptoms, treatment methods and overall outcomes. Specifically, we focused on factors such as patient age, the use of antivenom serum (ASV), time taken to reach the hospital, length of hospital stay and clinical outcomes like neurotoxicity, hematotoxicity and the need for dialysis, blood products, and mechanical ventilation.

The analysis showed that the average age of patients who suffered from snakebites was 33.05 years. The standard deviation was 13.04 years and the median age was 30 years. It can be observed that a significant portion of individuals affected by snakebites were in the young adult age group. Other studies have

found similar age distributions, like one that examined snakebite patients and found that the average age was 34 years[8]. This demographic trend aligns with research conducted in other areas, indicating that young adults who are actively engaged in agricultural work face a greater likelihood of snakebites due to their occupational exposure[6,9].

In our study, we observed that a significant number of patients experienced neurotoxicity (26.4%) and hematotoxicity (29.9%) as clinical manifestations of snakebite envenomation. Just a small fraction of the subjects, specifically 3.4%, displayed any other forms of toxicity. The results emphasize the considerable differences in how patients present clinically depending on the specific snake species and venom they encounter. A study conducted in Bangladesh revealed comparable results, indicating that 24.1% of cases exhibited neurotoxic symptoms and 28.3% showed hematotoxic symptoms[10]. In our study, the administration of ASV was a frequently used intervention, with an average of 21.37 vials per patient. The high utilization of treatment in this case indicates the seriousness of envenomations, which is in line with recommendations for aggressive ASV treatment for severe cases[11]. By contrast, a study conducted in Maharashtra, India, found that the average use of ASV was 18.5 vials per patient. This suggests that there are differences in treatment protocols across different regions. In contrast to our findings, a study conducted in Eastern India discovered that a significant portion of cases, specifically 48.6%, were treated with <10 vials of ASV. On the other hand, only 9.6% of cases received more than 20 vials[13].

It took an average of 8.5 hours for individuals to reach the hospital, with a middle value of 7.0 hours. This suggests a significant delay in receiving necessary medical attention. This delay is crucial because the effectiveness of ASV depends on time. Studies have shown that patients who receive treatment sooner have better outcomes[5]. A study conducted in Nepal revealed that the average duration for snakebite patients to reach the hospital was 5 hours. This emphasizes the significance of minimizing delays in order to enhance the prognosis[14]. In contrast, a study revealed that a small percentage of snakebite victims, specifically 18.5%, managed to reach the hospital within an hour. A slightly higher percentage, 26.8%, arrived within 1-4 hours, while the majority, 54.6%, arrived after 4 hours[15]. In our study, the average length of hospital stay was 5.5 days and the middle value was 5.0 days. This indicates that the majority of patients needed a longer period of medical attention to address complications and recuperate from the venomous bite. In line with previous research, the average length of hospitalization for individuals bitten by snakes was found to be 6 days[16]. On the other hand, a study conducted in Pakistan found that the average hospital stay was only 4 days. This could be due to variations in the seriousness of the snakebite or differences in healthcare approaches[17].

The results showed significant differences in outcomes depending on the occurrence of neurotoxicity and hematotoxicity. Individuals who experienced neurotoxicity had a mortality rate of 4.9%. In comparison, patients who experienced hematotoxicity had a mortality rate of 3.8%. These findings align with previous research, which highlights that neurotoxic and hematotoxic envenomations are linked to increased risks of severe complications and mortality[5,11]. According to a study conducted in Thailand, the mortality rate associated with neurotoxicity was found to be 7.5%[19]. A study conducted in Vietnam revealed a comparatively lower mortality rate of 7% associated with neurotoxicity. This finding suggests that there may be regional variations in the efficacy of treatment and management approaches[19].

The need for extensive medical treatments also differed. In a subset of cases, a small number of patients need blood products (8.0%) and mechanical ventilation (5.7%), which suggests that their condition was quite severe and affected their entire system. In this study, the mortality rate was 3.4%. The majority of patients, about 90.8%, were discharged, while 6.9% were referred for additional treatment. The distribution of outcomes highlights the significance of prompt and efficient medical intervention in decreasing the number of deaths and illnesses caused by snakebites. A study conducted in Nigeria found a comparable mortality rate of 4%, highlighting the widespread impact of snakebite envenomation worldwide[20]. On the other hand, a study conducted in Kenya found a higher mortality rate of 6%. This shows that the outcomes of snakebites can vary depending on the healthcare resources available in different regions and the severity of the bites[22].

When we look at other studies from different regions and countries, we see similar trends in demographics that are at high risk, the importance of giving ASV promptly and the difficulties caused by delays in getting medical care. For example, research conducted in different regions of India and South Asia show similar age patterns and highlight the importance of prompt medical intervention to enhance survival rates[9,22]. In a comprehensive analysis of snakebite epidemiology worldwide, it was found that areas with improved healthcare access and efficient response systems generally experience lower mortality rates. This underscores the crucial role of healthcare infrastructure in effectively managing snakebites[23].

Nevertheless, various studies have presented conflicting results when it comes to the seriousness and consequences of snakebite envenomations. These findings highlight the intricate relationship between the local environment, healthcare system and socioeconomic conditions.

CONCLUSION

This study offers insights into the epidemiological and clinical management of snakebites in Shivpuri located in Madhya Pradesh. The study highlights the high occurrence of snakebites among young adults and the unfortunate delays in receiving timely medical treatment, which have a negative effect on the final results. The study emphasises the importance of administering antivenom serum promptly and effectively managing serious complications such as neurotoxicity and hematotoxicity. It is crucial to implement effective public health strategies in order to decrease the number of snakebite-related illnesses and deaths. This can be achieved through community education and the enhancement of healthcare infrastructure. Further investigation is needed to enhance treatment protocols and tackle regional differences in snakebite management.

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