Section: General Medicine

Original Research Article

CLINICAL PROFILE, ADMISSION DELAY, AND MORBIDITY PATTERNS AMONG SNAKEBITE ENVENOMATION CASES: A PROSPECTIVE OBSERVATIONAL STUDY FROM A TERTIARY CARE CENTER IN SOUTH INDIA

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ABSTRACT

Background: Snakebite envenomation remains a major public health problem in India, particularly affecting rural and agrarian populations. Although mortality has reduced with improved availability of anti-snake venom (ASV) and standardized treatment protocols, morbidity related to delayed admission and local tissue complications continues to be substantial. The objective is to describe the clinical profile, admission delay, and morbidity patterns among patients admitted with snakebite envenomation. **Materials and Methods:** A prospective observational study was conducted over a period of one year among 500 patients admitted with snakebite envenomation to a tertiary care government hospital in South India. Socio-demographic characteristics, clinical profile, admission delay, treatment details, and morbidity outcomes were analyzed. **Result:** The majority of patients were males from rural areas and belonged to the economically productive age group. Delayed admission beyond 24 hours was observed in a significant proportion of patients and was strongly associated with increased morbidity, including cellulitis, prolonged hospital stay, and requirement for surgical intervention ($p < 0.001$). **Conclusion:** Snakebite envenomation continues to cause significant morbidity, primarily due to delayed hospital presentation and local tissue complications. Strengthening primary care-level recognition, referral systems, and community awareness is essential to reduce morbidity.

INTRODUCTION

Snakebite envenomation is recognized by the World Health Organization as a neglected tropical disease and remains a significant cause of morbidity and disability in low- and middle-income countries.[1] Globally, an estimated 5.4 million snakebites occur each year, resulting in nearly 2.7 million cases of envenomation and up to 138,000 deaths annually.[2] In addition to mortality, snakebite results in a large burden of non-fatal outcomes, including local tissue damage, permanent disability, psychological trauma, and socioeconomic loss.

India bears a disproportionate share of the global snakebite burden. This is attributed to its vast rural population, heavy dependence on agriculture, climatic conditions favourable for venomous snakes, and disparities in access to timely healthcare.[3] Snakebite predominantly affects individuals living in rural and tribal areas, where exposure risk is high and health-seeking behaviour is often delayed. The true burden of snakebite is likely underestimated due to underreporting and reliance on traditional healing practices in many regions.

Most snakebite victims belong to the young and middle-aged adult population, which constitutes the economically productive segment of society.[4] As a result, morbidity following snakebite has profound socioeconomic implications. Prolonged hospitalization, loss of workdays, repeated outpatient visits, and long-term disability can significantly impact household income, food security, and overall quality of life.[5]

Over the past few decades, improvements in emergency medical services, wider availability of anti-snake venom, and dissemination of national snakebite management protocols have contributed to a decline in snakebite-related mortality in several parts of India.[6] However, morbidity related to delayed admission and local tissue damage has not shown a proportional decline. Local tissue complications remain common and continue to place a substantial burden on patients and healthcare systems.

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Local manifestations of snakebite envenomation include pain, swelling, cellulitis, blistering, necrosis, compartment syndrome, and secondary bacterial infection.[7] Among these, cellulitis is one of the most frequently encountered complications and often serves as a marker of severity. These complications frequently lead to prolonged hospital stay, increased antibiotic use, surgical interventions such as fasciotomy or debridement, and in some cases, permanent functional impairment.

Admission delay has emerged as a critical and potentially modifiable determinant of morbidity in snakebite envenomation. In rural settings, delayed presentation to healthcare facilities is common due to multiple factors including lack of transportation, long distances to hospitals, financial constraints, and continued reliance on traditional healers.[8] During this delay, venom continues to exert its local and systemic effects, resulting in progressive tissue damage and increased risk of complications.[9]

Primary care physicians and family medicine practitioners play a pivotal role in the early management of snakebite. They are often the first point of contact for victims and are responsible for initial assessment, provision of first aid, and timely referral to higher centres.[10] Strengthening the capacity of primary care systems to recognize high-risk snakebite cases and ensure rapid referral is crucial for reducing morbidity.

Several studies from different regions of India have described the clinical profile and outcomes of snakebite envenomation.[11-13] However, many of these studies focus primarily on mortality or systemic complications, with relatively less emphasis on admission delay and morbidity patterns. There is a need for prospective studies that comprehensively evaluate socio-demographic factors, clinical presentation, admission delay, and morbidity outcomes to inform preventive strategies and health system strengthening.

The present study was undertaken to describe the clinical profile, admission delay, and morbidity patterns among snakebite envenomation cases admitted to a tertiary care center in South India, with special emphasis on public health and primary care relevance.

Objectives

1. To describe the socio-demographic and clinical profile of patients admitted with snakebite envenomation.
2. To assess the pattern of admission delay among snakebite envenomation cases.
3. To evaluate the association between admission delay and morbidity outcomes among snakebite patients.

MATERIALS AND METHODS

A prospective observational study was conducted at a tertiary care government hospital in Salem Tamil Nadu over a one-year period. The hospital functions as a referral center for surrounding rural, urban and semi-urban areas.

A total of 500 consecutive patients aged ≥13 years admitted with a history of snakebite envenomation were included after obtaining informed consent. Patients with pre-existing ulcerative skin lesions or chronic wounds at the bite site were excluded.

Data were collected using a structured proforma that included socio-demographic variables (age, sex, residence, occupation), clinical features, site of bite, time interval between bite and hospital admission, treatment details including ASV administration, and morbidity outcomes.

Admission delay was categorized as <8 hours, 8–24 hours, and >24 hours. Morbidity outcomes included development of cellulitis, local tissue complications, need for surgical intervention, and duration of hospital stay. Admission delay was categorized as ≤24 hours and >24 hours for analytical purposes. Morbidity outcomes assessed included development of cellulitis, duration of hospital stay, and requirement for surgical intervention.

Categorical variables were expressed as frequencies and percentages. The association between admission delay and morbidity outcomes was analyzed using the chi-square test, and a p value <0.05 was considered statistically significant.

RESULTS

A total of 500 patients with snakebite envenomation were included in the study. The majority were males and belonged to rural areas. Most patients were in the 30–60-year age group.

Table 1: Socio-demographic profile of snakebite patients in a study on snake envenomation in a tertiary care Hospital in South India.

Variable	n (%)
Male sex	285 (57.0)
Rural residence	410 (82.0)
Age 30–60 years	310 (62.0)

A total of 500 patients with snakebite envenomation were included in the study. [Table 1] shows that snakebite predominantly affected males (57%) from rural areas (82%), reflecting occupational and environmental exposure.

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Table 2: Admission delay and morbidity outcomes of snakebite patients in a study on snake envenomation in a tertiary care Hospital in South India.

Parameter	Observation
Admission >24 hours	24.6%
Cellulitis	70.2%
Prolonged hospital stay	Common

[Table 2] demonstrates a high prevalence of delayed admission and associated morbidity among the study population.

Table 3: Admission delay and morbidity outcomes among snakebite patients in a study on snake envenomation in a tertiary care Hospital in South India.

Morbidity outcome	Admission ≤24 h (n=377)	Admission >24 h (n=123)	χ^2 value	p value
Cellulitis	238 (63.1%)	113 (91.9%)	32.6	<0.001
Prolonged hospital stay (>5 days)	142 (37.7%)	86 (69.9%)	28.4	<0.001
Surgical intervention required	34 (9.0%)	29 (23.6%)	18.7	<0.001

This table demonstrates a statistically significant association between delayed hospital admission (>24 hours) and increased morbidity. Patients presenting after 24 hours had a significantly higher prevalence of cellulitis, prolonged hospital stay, and requirement for surgical intervention compared to those admitted within 24 hours.

DISCUSSION

The present study demonstrates that admission delay is a key determinant of morbidity among snakebite envenomation patients. While earlier studies have highlighted the burden of local tissue complications, the present analysis provides inferential evidence linking delayed admission with increased morbidity.[8-10]

Male predominance and rural residence observed in this study are consistent with previous Indian studies and reflect occupational exposure and environmental risk factors.[11,12] However, socio-demographic factors alone do not explain morbidity patterns. The strong association between delayed admission and adverse outcomes highlights the importance of health system factors and health-seeking behaviour.

Patients presenting after 24 hours were significantly more likely to develop cellulitis. This finding supports the hypothesis that prolonged venom activity at the bite site, compounded by delayed wound care, contributes to severe local inflammation and secondary infection.[7] Similar associations between delayed admission and local tissue damage have been reported in studies from South Asia.[9,13]

The observation that nearly one-fourth of snakebite victims presented after 24 hours indicates a substantial delay in health-seeking behaviour, which continues to contribute to morbidity despite improvements in snakebite management and referral systems Prolonged hospital stays and increased need for surgical intervention among late presenters further emphasize the economic and healthcare burden of delayed admission. From a primary care perspective, these findings underscore the need for early recognition, appropriate first aid, and rapid referral.

Although mortality was low in the present study, morbidity-related outcomes have significant socioeconomic implications. Loss of productivity, increased healthcare costs, and potential long-term disability highlight the importance of prioritizing morbidity reduction in snakebite control programs.

CONCLUSION

Admission delay is a significant and modifiable determinant of morbidity following snakebite envenomation. Early presentation to healthcare facilities can substantially reduce local tissue complications, hospital stay, and need for surgical intervention.

Strengths and Limitations

Strengths: Prospective study design and adequate sample size.

Limitations: Single-centre setting and lack of long-term follow-up for functional outcomes.

Recommendations: A strengthened community awareness programs on early hospital presentation after snakebite is very much essential. We need to improve the training of primary care physicians in early recognition and referral. We need to establish a strong rural transport and referral systems. A great emphasize on standardized management of local tissue complications is very much essential. In going forward, we need to conduct long-term studies assessing functional outcomes and quality of life.

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