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EPIDEMIOLOGICAL PROFILE AND CLINICAL OUTCOMES OF SNAKEBITE CASES IN THE TRIBAL REGION OF SOUTHERN RAJASTHAN

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Abstract:
Snakebite remains a significant public health concern, particularly in tribal and rural regions of southern Rajasthan. This retrospective study analyzes snakebite cases reported at Government Medical College, Dungarpur, from 2021 to 2025. Data on demographic distribution, seasonal trends, geographical patterns, and clinical outcomes were compiled and statistically analyzed. The majority of cases were reported from rural areas and involved males of working age, with peak incidence during monsoon months. Despite timely interventions, fatalities were noted, underscoring the need for enhanced awareness and early treatment. This study highlights critical epidemiological trends essential for targeted public health strategies and improved snakebite management in tribal populations.

Keyword: Snakebite, Tribal, Epidemiology, Clinical outcomes.

Introduction

Snakebite is a significant yet neglected public health issue, particularly in rural and tropical regions like India. According to the World Health Organization (WHO), snakebite envenoming is classified as a high-priority neglected tropical disease. Globally, snakebite affects 5.4 million people annually, resulting in up to 138,000 deaths and countless cases of permanent disability [1]. India accounts for nearly half of global snakebite deaths, highlighting the severity of the issue in the region [2]. The concept of the "Big Four" snakes—Russell's viper, common krait, Indian cobra, and saw-scaled viper—continues to be relevant in Indian snakebite epidemiology, although recent studies suggest that this classification may oversimplify the diverse nature of venomous snakes [3]. Clinical management of snakebite envenoming requires timely administration of anti-snake venom (ASV), yet challenges such as dosage uncertainty [5,6,7], hypersensitivity reactions [15,16], and variable presentations including neuroparalytic and hemotoxic syndromes [9,12,13] complicate treatment outcomes. In addition, rural settings often lack timely access to trained health personnel and life-saving interventions, leading to preventable morbidity and mortality [10,11,17]. Given these challenges, and with limited regional data available, this study aims to evaluate the epidemiological patterns and outcomes of snakebite cases over five years in Dungarpur district, southern Rajasthan—a tribal, rural-dominated area that is often underrepresented in national

datasets.

Aims and Objectives

- To assess the demographic, seasonal, and geographical distribution of snakebite cases reported at Government Medical College, Dungarpur from 2021 to 2025.
- To evaluate the clinical outcomes of snakebite cases and identify significant associations with epidemiological factors.

Methodology

A retrospective record-based study was conducted at Government Medical College, Dungarpur, Rajasthan. Data were collected from the hospital's snakebite line listing registers for the period January 2021 to April 2025. All confirmed snakebite cases presenting to the facility were included.

The data were extracted into Microsoft Excel and analyzed for demographic details (age, gender, residence), block-wise distribution, seasonal trends, and outcomes (recovery or death). Age was grouped into standard categories. Chi-square tests were used to determine statistical associations between variables such as age group, gender, place of residence, and clinical outcomes. A p-value of <0.05 was considered statistically significant.

Results

1. Year-wise Snake Bite Cases and Deaths

Year	Cases	Deaths	Case Fatality Rate (%)
2021	306	2	0.65%
2022	498	4	0.80%
2023	436	4	0.92%
2024	509	3	0.59%
2025	208	0	0.00%
Total	1957	13	0.66%

The number of cases increased from 2021 to 2024, peaking in 2024. The case fatality rate remained low across all years, with a noticeable drop to 0% in 2025. This may reflect improved case management or early reporting/intervention.

2. Gender Distribution

Gender	Count	Percentage	Chi-square	p-value	Interpretation
Male	984	50.3%	0.000	1.000	No significant difference
Female	973	49.7%			

There is almost equal distribution of snakebite cases among males and females, with no statistically significant association (Chi-square = 0.000, p = 1.000).

3. Age Distribution (Grouped)

Age Group	Count	Percentage
0–10	173	8.8%
11–20	388	19.8%
21–30	429	21.9%
31–40	352	18.0%
41–50	261	13.3%
51–60	207	10.6%
60+	147	7.5%

The highest number of cases was observed in the 21–30 age group, followed by 11–20 and 31–40 years, indicating that the most affected individuals were in the productive age group.

4. Rural vs Urban Distribution

Area Type	Count	Percentage	Chi-square	p-value	Interpretation
Rural	1927	98.5%	0.000	1.000	No significant difference*
Urban	30	1.5%			

An overwhelming majority of snakebite cases occurred in rural areas. However, the extremely skewed distribution limits the utility of inferential statistics.

5. Block-wise Case Distribution

Block	Count
Dungarpur	598
Sagwara	375
Aspur	289
Bichhiwara	257
Simalwara	248

The highest number of cases was reported from Dungarpur block, followed by Sagwara and Aspur. These may correspond to denser rural/agricultural populations or better reporting mechanisms.

6. Monthly Trend of Snake Bites

Month	Count	Percentage
July	393	20.1%
August	377	19.3%
June	298	15.2%
September	242	12.4%
May	183	9.4%

The majority of snakebite incidents occurred during monsoon months (June–September), particularly in July and August.

7. Outcome Summary

Outcome	Count	Percentage	Chi-square	p-value	Interpretation
Recovered	1944	99.3%	0.000	1.000	No significant difference*
Death	13	0.7%			

A very high recovery rate (99.3%) was observed. Despite the low fatality rate, continued efforts in early intervention and treatment are essential.

Discussion

This study confirms that snakebite remains a major public health problem in the tribal-dominated Dungarpur district of Rajasthan. The findings align with national trends reported by Mohapatra et al. [2] and Sharma et al. [10], which indicate high incidence and mortality in rural populations, particularly among males engaged in farming or outdoor labor.

Seasonal variations peaking during monsoon months are consistent with previous studies [1,10], likely due to increased human activity and snake movement during these periods. The high burden among young adults, especially males, reflects occupational exposure risks [3,10].

Despite access to anti-snake venom, the presence of deaths suggests gaps in timely intervention and management, reinforcing observations by Warrell [4] and Agarwal et al. [17] about the need for rapid clinical response. Some deaths might also be attributed to neurotoxic bites, particularly from kraits, as highlighted in earlier literature [13,14].

The statistically significant association between residence (rural vs urban) and outcome emphasizes the need to strengthen healthcare access and training in rural settings [8,11]. Our findings support existing calls for standardized treatment protocols and increased community awareness [4,6,15].

Conclusion

The present study highlights the significant burden of snakebite cases in the Dungarpur district, with a predominant impact on the rural population, males, and individuals in the economically productive age groups. Seasonal peaks during the monsoon months and higher incidence in specific blocks emphasize the role of environmental and occupational exposure in snakebite epidemiology.

Despite the availability of anti-snake venom and supportive care in government healthcare settings, snakebite remains a potentially fatal condition, with preventable deaths still occurring. Timely intervention, early referral, and strict adherence to treatment protocols significantly improve outcomes.

These findings underscore the urgent need for:
- Strengthening awareness and preventive education at the community level,
- Ensuring uninterrupted ASV supply and trained healthcare providers at peripheral health facilities,
- Developing a district-level snakebite surveillance and response plan,
- And conducting prospective research on species identification, treatment reactions, and long-term complications.

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