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Original Research Article

CLINICAL PROFILE AND MANAGEMENT OUTCOMES OF SNAKEBITE PATIENTS IN A TERTIARY CARE HOSPITAL IN CENTRAL INDIA

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ABSTRACT

Background: Snakebites are a significant public health concern in tropical regions, often resulting in substantial morbidity and mortality. This study aims to analyse the demographic characteristics, clinical presentations, management protocols and outcomes of snakebite cases admitted to a tertiary care hospital in central India. **Materials and Methods:** This retrospective observational study was conducted at a tertiary care hospital over a three-year period (March 2022–February 2025). Data was collected from medical records of 155 snakebite patients including demographic details, clinical presentations, laboratory findings, treatment protocols and outcomes. **Result:** The study revealed a male predominance (65.16%), with most patients (92.25%) residing in rural areas and aged 21–40 years (54.18%). Snakebites were most common during the monsoon season (83.87%) and primarily affected individuals in agricultural or labor-intensive occupations (43.22%). Bites on the lower limbs (67.09%) were most frequent. Clinical features included localized pain, swelling, hematological abnormalities, and neurotoxic effects. Anti-snake venom (ASV) was administered in all cases and 18.70% required mechanical ventilation. Out of 155 patients, 144 (92.90%) survived, while 11 (7.10%) patients died. The mortality was significantly higher among study subjects with complications as Respiratory Paralysis and DIC (P=0.0043; P=0.0015) as compared to other complications. **Conclusion:** Snakebites predominantly affect young rural males during the monsoon. Timely first aid, early ASV administration and appropriate hospital care significantly reduce mortality. Strengthening rural healthcare systems and ensuring availability of ASV and supportive care can further improve outcomes for snakebite victims.

INTRODUCTION

Snakebite envenomation is a significant public health problem in many parts of the world, particularly in tropical and subtropical regions. According to the World Health Organization (WHO), snakebites are classified as a Neglected Tropical Disease (NTD), affecting millions of people annually, with a substantial burden in rural and resource-limited settings.[1,2] The true extent of the problem is not known, but globally, each year, an estimated more than 5 million people are bitten by snakes resulting in approximately 50,000–1,25,000 deaths. India accounts for a major proportion of these cases with an estimated 35,000 deaths each year, but the exact figures may be much higher as many patients still prefer going to traditional healers for the treatment due to the lack of awareness.[3,4] Delay in seeking medical aid or ignorance among primary care physicians about the correct treatment of snake-bite is also responsible for the high morbidity and mortality.[5] The incidence of snakebite is particularly high in the rural areas where people come in direct contact with snakes owing to occupations such as farming and forest activities.[1]

Patients with snakebite may present with symptoms of the central nervous system, coagulation abnormalities with hemolysis and renal failure, disseminated intravascular coagulation or shock which may require a multiple team approach in the intensive care unit.[1] However, snakebite outcomes are influenced by several factors including the type

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of snake, severity of envenomation, time to treatment and availability of healthcare resources. Effective treatment including timely administration of anti-snake venom (ASV) and appropriate supportive care, plays a pivotal role in reducing mortality and morbidity.[6]

There is limited data on the clinical profile, management strategies and outcomes of snakebite patients in tertiary care settings, particularly in regions like Central India.[7] This study aims to analyse the demographic characteristics, clinical presentations, management protocols, and outcomes of snakebite cases admitted to a tertiary care hospital.

MATERIALS AND METHODS

This was a record-based retrospective, descriptive study conducted at the tertiary care hospital in Central India by analysing hospital records of patients admitted to the Medical Intensive Care Unit (MICU) of Government Medical College and Hospital, Nagpur, Maharashtra due to snakebite envenomation over a three-year period, from March 2022 to February 2025. The study included 155 patients with a confirmed history of snakebite who were admitted to the MICU during the study period. Cases were identified through hospital records and those with incomplete documentation or unclear diagnoses were excluded.

Patient data were extracted from hospital records using a predesigned proforma to ensure consistency and completeness. The following information was collected:

- **Demographics:** Age, gender, residence and occupation.
- **Bite Characteristics:** Site of the snakebite and fang marks (e.g., upper limb, lower limb), and Time of bite, Seasonal variation.
- **Clinical Features:** Vital signs at the time of presentation including Single Breath Count (SBC), Presenting symptoms and signs, including local and systemic manifestations such as pain, swelling, bleeding, neurotoxic features such as ptosis, vomiting.
- **Investigations:** Routine investigations like Complete Blood Counts, kidney fuction tests, liver function tests, PT-INR and urine examination for hematuria from Microbiology department. 20 minute Whole Blood Clotting Time (WBCT).
- **Treatment Details:** Administration of Anti-Snake Venom (ASV), dosage, any adverse reaction to ASV, Neostigmine and Atropine and other supportive treatments, such as mechanical ventilation, blood or fresh frozen plasma transfusion, hemodialysis, antibiotics , any surgical intervention.
- **Complications:** Any documented complications, such as sepsis, acute kidney injury, coagulopathy, or respiratory failure, reaction to ASV.
- **Outcomes:** Patient outcomes were categorized as survived or died.

As this was a retrospective study using anonymized patient records, informed consent was not required. All data were handled confidentially and used solely for research purposes.

Statistical analysis

The collected data were compiled, organized, and analysed using descriptive statistics. Continuous variables were presented as means with standard deviations, while categorical variables were expressed as frequencies and percentages. Trends and associations were assessed to identify patterns in clinical presentation, management, and outcomes. Chi-square test used for comparison. P value <0.05 was considered statistically significant.

RESULTS

[Table 1] presents the socio-demographic profile of patients. The majority of patients were in the 21-30 years age group (28.38%), followed by 31-40 years (25.80%) and 41-50 years (21.29%). The mean age of patients was 38.16±14.23 years, ranged from 12 to 73 years with male predominance (65.16%). In terms of occupation, the largest group were agricultural workers and laborers (43.22%), followed by unskilled workers (34.19%). The majority of patients resided in rural areas (92.25%), with a smaller proportion living in urban areas (7.75%).

Table 1: Socio-Demographic profile of patients

Demographic data		Frequency	Percentage
Age groups in years	11-20	11	7.09
	21-30	44	28.38
	31-40	40	25.80
	41-50	33	21.29
	51-60	19	12.25
	>60	08	5.16
Gender	Male	101	65.16
	Female	54	34.84
Occupation	Agricultural workers and laborers	67	43.22
	Skilled Worker	13	8.38
	Unskilled	53	34.19
	Unemployed	02	1.29
	Student	09	5.80
	Homemaker	11	7.09
Residence	Rural	143	92.25

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	Urban	12	7.75

The most common species identified was the Saw-scaled Viper, accounting for 17.65% of cases, followed by the Russell Viper at 5.88%. Krait bites made up 3.92%, while the majority of cases (72.55%) involved unidentified snake species.

Majority of the patients had bite on the lower limb 67.09%. The incidence of bite in the upper limb was 32.91%. Most bites occurred at night (59.35%), with fewer incidents in the morning (27.74%), evening (10.32%), and afternoon (2.58%). Snake bites were most frequent during the monsoon season (83.87%), with fewer cases in summer (11.61%) and winter (4.51%), [Table 2].

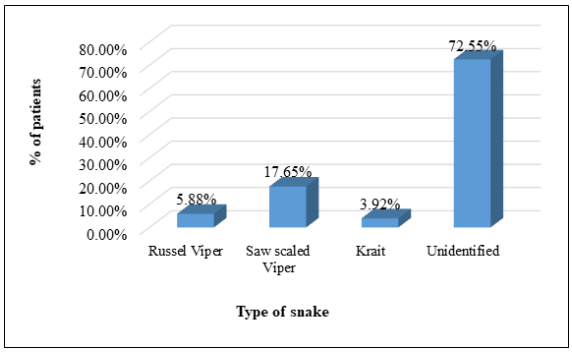

Figure 1: Distribution of Species of Snake bite

Table 2: Bite Characteristics.

Bite Characteristics		Frequency	Percentage
Site of the snakebite	Right foot	49	31.61
	Left foot	55	35.48
	Right arm	27	17.42
	Left arm	24	15.49
Time of bite	Night	92	59.35
	Morning	43	27.74
	Afternoon	04	2.58
	Evening	16	10.33
Seasonal variation	Monsoon	130	83.87
	Summer	18	11.61
	Winter	07	4.52

Among general manifestations, pain was the most common (78.06%), followed by swelling and local rise in temperature (67.09% each). Nausea/vomiting (28.38%) and blisters (14.19%) were also noted. Neurological manifestations included ptosis (21.29%), respiratory paralysis (15.48%), and ophthalmoplegia (14.83%). Hematological manifestations were marked by bleeding from the bite site (44.51%) and cellulitis (42.58%), with other signs like hematuria (16.12%) and ecchymosis (14.83%) occurring less frequently, [Table 3].

Table 3: Distribution of study subjects according to the clinical manifestations at the time of admission

Clinical manifestations (n =155)		Frequency	Percentage
General manifestation (n=155)	Pain	121	78.06
	Swelling	104	67.09
	Local rise of temperature	104	67.09
	Nausea/Vomiting	44	28.38
	Blisters	22	14.19
	Lymphadenopathy	17	10.96
	Discoloration	11	7.09
	Ulceration	8	5.16
Neurological manifestation (n=51)	Ptosis	33	21.29
	Respiratory paralysis	24	15.48
	Ophthalmoplegia	23	14.83
	Bulbar weakness	18	11.61
	Paralysis of limbs	13	8.38
	Loss of consciousness	11	7.09
Hematological manifestation (n=88)	Bleeding from site of bite	69	44.51
	Cellulitis	66	42.58
	Haematuria	64	41.29
	Ecchymosis	23	14.83
	Epistaxis	14	9.03
	Haemoptysis	09	5.80
	Gastrointestinal bleeding	02	1.29

Most patients received anti-snake venom (ASV) within 1-6 hours (42.56%) or less than 1 hour (33.54%). Mechanical ventilation was required in 18.70% of cases. Inotropic support and central venous catheterization were needed in 34.19% of cases each. Other interventions included ultrasound abdomen (7.09%), hemodialysis (4.51%), blood and

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blood products (5.80%), and CT brain (1.29%) [Table 4].

Table 4: Interventions done in intensive care unit

Intervention		Frequency	Percentage
ASV received (in hours)	<1	52	33.54
	1-6	66	42.56
	7-12	17	10.90
	13-18	09	5.80
	19-24	06	4.00
	>25	05	3.20
Mechanical ventilation (h)	<12	02	01.29
	12-24	03	01.93
	>24	24	15.48
Inotropic support		53	34.19
Central venous catheter		53	34.19
Ultrasound abdomen		11	7.09
CT brain		02	1.29
Hemodialysis		07	4.51
Blood and blood products		09	5.80

Out of 155 patients, 144 (92.90%) survived, while 11 (7.10%) patients died as depicted in [Figure 2].

Among the 51 individuals who did not receive first aid or relied on herbal medicine, 13.72% (7) died, and 86.27% (44) survived. In contrast, among the 104 individuals who received proper first aid, 3.84% (4) died, while 96.15% (100) survived [Table 5].

[Table 6] showed that mortality was significantly higher among study subjects with complications such as Respiratory Paralysis (P = 0.0043) and Disseminated Intravascular Coagulation (DIC) (P = 0.0015) compared to other complications.

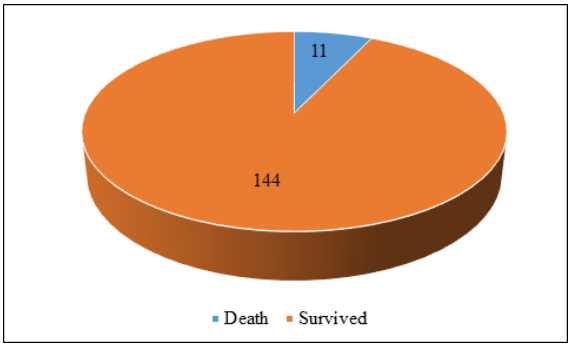

Figure 2: Outcome of snake bite management

Table 5: Outcome of the study subjects with the type of first aid measure received

First Aid Measure	Died	Survived	Total	P value
No First Aid/ Herbal medicine	07 (13.72%)	44 (86.27%)	51 (100.0%)	0.0244*
Received	04 (3.84%)	100 (96.15%)	104 (100.0%)	
Total	11 (7.09%)	144 (92.90%)	155 (100.0%)	

Table 6: Complications of snake bite and mortality

Complications	Study subject (n=144)	Mortality (n=11)	P-value
Cellulitis/ Wound infection	64 (44.44%)	02 (3.03%)	0.089
Renal failure	50 (34.72%)	06 (12.0%)	0.187
Respiratory paralysis	19 (13.19%)	05 (20.83%)	0.0043*
DIC	06 (4.16%)	03 (50.0%)	0.0015*
Sepsis	03 (2.08%)	01 (33.33%)	0.157
Gangrene at site of bite	02 (1.38%)	00 (0.0%)	-

It was observed that patients of mortality group received more ASV than those of survived group (Mean 393.67 ml vs. 311.96 ml and median 314 ml vs. 221 ml). It was also observed that maximum duration of hospital stay was between 5 to 7 day (37%) followed by 2 to 4 days (34%) with mean of 6.54 days.

DISCUSSION

In the present study, the majority of study subjects (54.18%) were from the younger population (21-40 years of age), likely due to their more ambulant nature, which is consistent with earlier reports.2,8,9 The mean age of patients was 38.16±14.23 years with male predominance (65.16%) which were similar to the findings of Gupta et al,[1] Bhelkar SM et al,[2] and Mahmood et al.[10] The majority of patients belonged to a rural background (92.25%) involved in agricultural activities (43.22%) which is in accordance with various previous studies which have reported similar demographic profile of patients where young men in rural areas are mainly involved in agricultural activities, thereby increasing their risk of snakebites.[1,11]

Commonly encountered snakes in India include krait, cobra, saw scaled viper and Russel viper.[12] In the present study, the most common species identified was the Saw-scaled Viper (17.65%) followed by the Russell Viper at 5.88%. Krait bites made up 3.92%,

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while the majority of cases (72.55%) involved unidentified snake species. Lower limbs were the most common site of bite (67.09%) as similar to Gupta et al,[1] and Bhelkar SM et al,[2] which represents the inadvertent bites during the agricultural activity and walking through vegetation. Most bites occurred at night (59.35%), with fewer incidents in the morning (27.74%), evening (10.32%), and afternoon (2.58%). The bites on the trunk and upper limb were mainly during the night an early morning when the patients were sleeping on the floor. Krait bites are more common during the night, whereas cobra and viper bites are more common in the daytime. Sharma et al. have reported an increased incidence of snakebites, whereas the patients were sleeping on the floor (92.5%).[13] The maximum number of bites in our study were reported during the monsoons (83.87%) as was observed in previous studies which can be attributed to the fact that during the monsoon season there is flooding of the habitats of the snakes and their prey which causes the snakes to come out of their dwellings increasing the human snake conflict.[1,2,14,15]

The majority (72.82%) of study subjects in the present study had signs of envenomation, which were similar to the results of studies conducted by Bhelkar SM et al,[2] and Tan et al.[16] However, Logaraj et al,[17] reported a lower incidence of envenomation. Most of the snakebite cases in the present study were classified as hematotoxic (56.77%) or neuroparalytic (32.90%). Among the hematotoxic snakebites, bleeding from the bite site was the main manifestation, followed by cellulitis, hematuria, and ecchymosis. These findings were consistent with those observed in studies by Bhelkar SM et al,[2] and Sharma et al.[18] Traditional treatment was sought by 32.90% of study subjects in the current study, a finding contrast to that reported by Sloan et al,[19] where 80% of study subjects sought traditional treatment following a bite. However, different studies have reported different percentage of traditional treatment seeking behaviour as it depends upon various factors including location, socioeconomic status, education and available healthcare facilities etc.

Mechanical ventilation was the required in 18.70% patients done in the ICU with maximum i.e., 15.48% requiring it for more than 24 hours. They were mechanically ventilated for a mean period of 2.2 days, and the duration of ICU stay was 3–13 days (mean 5.4 days). Most patients received anti-snake venom (ASV) within 1-6 hours (42.56%) or less than 1 hour (33.54%). These findings are comparable with the study done by Gupta, et al.[1]

Death after snake bite in present study was 7.10% which is comparable with the study done by Bhelkar SM et al,[2] (5.77%), Mitra et al,[20] (5.7%) and Panwar and Dang (11.7%).[21] However, a variation 3%–10% in death number after snake bite were reported in various studies which were conducted by Kulkarni et al,[22] and Hati et al.[23] The high mortality rate in India has been attributed to the geographical factors and a predominantly rural population that was dependent on agriculture as an occupation.

Proportion of study subject who died was higher among those who did not receive first Aid measures or took herbal medicine as compared to those who received first Aid measures. This difference was found to be statistically significant (P=0.0244). The mortality was significantly higher among study subjects with complications as Respiratory Paralysis and DIC (P =0.0043; P =0.0015) as compared to other complications in subjects. Similar findings are reported in study conducted by Bhelkar SM et al.[2]

CONCLUSION

The present study findings demonstrate that snakebite incidents predominantly affect younger, rural males, especially those engaged in agricultural or labor-intensive occupations, with a seasonal peak during the monsoon. The study underscores the importance of timely and appropriate first aid and hospital care in reducing mortality rates. Patients receiving proper first aid and early ASV administration had significantly better outcomes. Mortality was associated with severe complications such as disseminated intravascular coagulation and respiratory failure, emphasizing the need for early recognition and management of such conditions. Strengthening healthcare infrastructure in rural areas and ensuring the availability of ASV and supportive treatments can further improve outcomes for snakebite victims.

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