Journal of Cardiovascular Disease Research

ISSN:0975 -3583,0976-2833 VOL15, ISSUE 02, 2024

MORTALITY PATTERN OF PATIENTS IN SNAKE BITE POISONING

Sonawane Niteen Ajinath[1], Ajit Kumar Sawhney[2], Ranjan Agrawal[3], W.P. Singh[4]

[1]Final year post-graduate, Department of General Medicine, Rajshree Medical Research Institute, Bareilly-243501, India

[2]Professor, Department of General Medicine, Rajshree Medical Research Institute, Bareilly-243501, India

[3]Prof & HOD, Department of Pathology, Rajshree Medical Research Institute, Bareilly-243501, India

[4]HOD & Professor, Department of General Medicine, Rajshree Medical Research Institute, Bareilly-243501, India

Corresponding author: Dr. Sonawane Niteen Ajinath

Final year post-graduate, Department of General Medicine, Rajshree Medical Research Institute, Bareilly-243501, India

Email: sonawaneniteen1@gmail.com, profdrwpsingh@gmail.com

Abstract-

Introduction: Snakebites pose a significant public health challenge globally, with India hosting over 250 venomous snake species. This study focuses on four major venomous land snakes, including the saw-scaled viper, responsible for numerous incidents worldwide. Snakebites result in millions of cases annually, with India reporting a substantial number, though the actual incidence and mortality rates may be underestimated due to traditional treatments in rural areas.

Objective: The research aims to evaluate clinical parameters in patients with poisonous snakebites, emphasizing clinical predictors of mortality.

Methodology: Conducted at a Medical College and Hospital from January to November 2023, the study involved 432 snakebite patients, with 260 exhibiting envenomation signs. Clinical criteria and treatments were standardized, and patient outcomes were monitored. Statistical analysis utilized SPSS version 26.0.

Results: Among 260 patients, 58 did not survive, resulting in a mortality rate of 22.3%. No significant age or gender differences were observed between survivors and non-survivors. Rural areas accounted for a higher incidence, and September had the peak admission of patients. Lower limbs were predominantly affected (75.8%). Local pain and swelling were common symptoms. Bleeding tendencies, respiratory failure, and shock were associated with higher mortality.

Discussion: Mortality rates varied, and factors like delayed hospital arrival, respiratory failure, acute renal failure, severe coagulopathy, and shock were identified as contributors to death. The study highlighted the correlation between mortality and complications such as bleeding tendencies and respiratory failure.

Conclusion: The study concludes that predicting mortality in snakebite patients is feasible using straightforward variables like bleeding tendencies, respiratory failure, and shock. These findings can aid healthcare practitioners in directing high-risk cases to advanced facilities promptly. Availability

of Anti-snake venom at Primary Health Centers and raising awareness about prompt hospitalization can improve outcomes.

Keywords: - Venomous snakes, Poisoning, Mortality, Mortality pattern, Snake envenomation

INTRODUCTION

Approximately 2,500 snake species are present globally, with India hosting more than 250 species and subspecies, of which 50 are venomous.[1-13] The country faces public health challenges primarily from four venomous land snakes. These include elapidae, represented by the cobra (Naja naja) and krait (Bungarus caeruleus), as well as viperidae, which encompass the Russell's viper (Daboia russelii).

The saw-scaled viper (Echis carinatus) is responsible for numerous snakebite incidents worldwide. Approximately 5 million people suffer snakebites annually, resulting in around 125,000 fatalities.[14-19] In India alone, over 200,000 snakebite cases are reported each year, with 35,000-50,000 of them proving fatal.[20-25] It is crucial to note that hospital-based data may underestimate the actual incidence and mortality rates of snakebites.[26,26] Numerous individuals in rural areas opt for traditional treatments, leading to fatalities at home or during the course of treatment.

This research was conducted to evaluate clinical parameters in patients with poisonous snakebites admitted to our institution. The study aimed to assess various clinical predictors of mortality in these cases.

METHODOLOGY

This study, conducted from January to November 2023 at the Medical College and Hospital's Department of Medicine, involved 432 snake bite patients, 260 of whom showed signs of envenomation and consented to participate. The study's approval was granted by the Institutional Ethical Committee.

Methods included identifying venomous snake bites through symptoms like fang marks, swelling, coagulation issues, and snake identification. Neurotoxicity, oliguria, acute renal failure, thrombocytopenia, severe coagulopathy, and shock were defined and diagnosed based on specific clinical criteria. Treatment involved tetanus toxoid, anti-snake venom, and in cases of neuroparalysis, neostigmine and atropine. Patient outcomes were monitored and categorized as either discharged or expired.

Statistical analysis utilized various relevant tests using SPSS version 26.0.

RESULTS

In a sample of 260 patients, 58 individuals did not survive, while 202 individuals survived, resulting in a mortality rate of 22.3%. The average age of all patients was 34.97 ± 14.07 years. The mean age of survivors (Group A) was 35.02 ± 14.12 years, and for non-survivors (Group B), it was 34.81 ± 14.00 years (P = 0.920), indicating no significant difference between the two groups. Regarding gender distribution, 170 patients (65.4%) were males, and 90 (34.6%) were females, resulting in a

ISSN:0975 -3583,0976-2833 VOL15, ISSUE 02, 2024

male-to-female ratio of 1.9:1. When considering the patients' residence, 186 individuals (71.5%) were from rural areas, while 74 (28.5%) were from urban areas, yielding a rural-to-urban ratio of 2.5:1. Among survivors (Group A), 142 (70.3%) were from rural areas, and 44 (75.9%) were from urban areas. In non-survivors (Group B), 60 (29.7%) were from rural areas, and 14 (24.1%) were from urban areas (P = 0.408). Out of the 58 patients who did not survive, 44 (75.9%) came from rural areas, and 14 (24.1%) came from urban areas.
The peak admission of patients was observed in September, accounting for 51 cases (19.6%). A majority of snakebite incidents, approximately 63.4%, occurred during the rainy season, spanning from June to September. Following this, the winter season (October to January) saw 60 admissions, representing 23.1% of cases. During the summer months (March to May), 27 patients (10.4%) were admitted.

Lower limbs (LL) were affected in 75.8% of cases, totaling 197 patients, while 23.8% (62 patients) experienced snake bites on their upper limbs (UL). A single patient with a bite on the head, face, or neck (HFN-ear) survived. Among survivors (group A), 74.7% had lower limb bites, while non-survivors (group B) had 79.3% of bites on the lower limbs (P = 0.475). Bites on upper limbs occurred in 24.8% of survivors and 20.7% of non-survivors (P = 0.522). Refer to Table 1 for details on snake identification in the study.

All 260 patients (100%) reported pain at the local bite site. Local swelling ranked as the second most prevalent complaint, affecting 252 individuals (96.9%), while blackening of the skin and the presence of blebs were observed in 18 cases (6.9%). Local swelling occurred in 195 (96.5%) of survivors and 57 (98.3%) of non-survivors (P = 0.688). Blackening of the skin, blisters, and blebs were noted in 10 survivors (4.9%) and 8 non-survivors (13.8%), with a statistically significant difference (P = 0.019). Table 2 illustrates the systemic symptoms.

Out of the total, 77 patients (29.6%) exhibited bleeding tendencies, with 48 (62.3%) of them succumbing to the condition. Among these cases, 66 (85.7%) experienced bleeding from the bite site, 42 (54.5%) had hematuria, 49 (63.6%) presented with melena, and 11 (14.3%) had bleeding from other sites, such as gums, epistaxis, subconjunctival bleed, and ecchymotic patches. Bleeding from the bite site was observed in 23 patients (79.3%) in the survivor group and 43 patients (89.6%) in the non-survivor group (P = 0.212). Hematuria was reported in 14 survivors (48.3%) and 28 non-survivors (58.3%) (P = 0.390). Melena was noted in 18 survivors (62.1%) and 31 non-survivors (64.6%), with no statistically significant difference (P = 0.824). Bleeding from other sites, including gums, occurred in 5 survivors (17.2%) and 6 non-survivors (12.5%) (P = 0.565).

Table 1: Snake identification

	All patients (*n*=260) (%)	**Survivors (A) (*n*=202) (%)**	**Non-survivors (B) (n=58) (%)**	***P* value**
Cobra	19 (7.3)	12 (5.9)	7 (12.1)	0.114
Krait	21 (8.1)	13 (6.4)	8 (13.8)	0.07
Russell’s viper	74 (28.5)	52 (25.7)	22 (37.9)	0.07

ISSN:0975 -3583,0976-2833 VOL15, ISSUE 02, 2024

Saw-scaled viper	30 (11.5)	27 (13.4)	3 (5.2)	0.085
Unidentified	116 (44.6)	98 (48.6)	18 (31.0)	-

Table 2: Systemic symptoms				
	All patients	**Survivors**	**Non-survivors**	***P* value**
(*n*=260)		**(A)**	**(B)**	
(%)		**(*n*=202) (%)**	**(*n*=58) (%)**	
Vomiting	155 (59.6)	104 (51.5)	51 (87.9)	<0.001
Bleeding tendency	77 (29.6)	29 (14.4)	48 (82.7)	<0.001
Neuroparalysis	65 (25)	37 (18.3)	28 (48.3)	<0.001
Decreased urine output	64 (24.6)	28 (13.9)	36 (62.1)	<0.001
Altered sensorium, convulsions	10 (3.8)	6 (2.9)	4 (6.9)	0.171

Table 3: Laboratory investigations in patients with acute renal failure and coagulopathy				
Kidney function tests in patients with acute renal failure (*n*=80)				
Parameter	**Patients with ARF (*n*=80)**	**Survivors (A) (*n*=35)**	**Non-survivors (B) (*n*=45)**	***P* value**
Mean blood urea (mg/dl)	141.40+44.75	133.85+54.84	147.26+34.50	0.185
Mean sr. creatinine (mg/dl)	4.98+2.09	4.32+1.89	5.49+2.12	0.012
Mean Na+(mEq/L)	133.87+7.33	134.82+7.89	133.13+6.86	0.309
Mean K+(mEq/L)	4.48+1.01	4.38+0.97	4.56+1.04	0.431
Hematological profile in patients with coagulopathy (*n*=77)				
Parameter	**All patients (*n*=77)**	**Survivors (A) (*n*=29)**	**Non-survivors (B) (*n*=48)**	***P* value**
Mean Hb (gm/dl)	9.49+1.74	10.17+2.03	9.81+1.55	0.412
Mean platelet count (lakhs/cmm)	0.52+0.23	0.61+0.23	0.47+0.22	0.006
Mean PT (sec)	20.67+5.09	19.65+3.19	21.29+5.90	0.174
Mean PTTK (sec)	57.59+16.71	48.24+14.96	63.25+15.21	<0.001

Table 4: Correlation of complications and mortality				
Complication	**All patients**	**Survivors**	**Non-survivors**	***P* value**
	(n=260)	**(A)**	**(B)**	
	(%)	**(*n*=202) (%)**	**(n=58) (%)**	
ARF	80 (30.8)	35 (17.3)	45 (77.6)	<0.001
Severe coagulopathy	77 (29.6)	32 (15.8)	45 (77.6)	<0.001

Respiratory failure	33 (12.7)	9 (4.5)	24 (41.4)	<0.001
Shock	29 (11.2)	2 (0.9)	27 (46.5)	<0.001
Extensive cellulitis with skin necrosis	18 (6.9)	10 (4.9)	8 (13.8)	0.019

Table 5: Multivariate analysis of various predictors of mortality in snake bite patients

Variable	**Hazard ratio**	**95% confidence interval**	***P* value**
Bite to hospital time	1.004	0.995-1.014	0.358
Vomiting	1.415	0.554-3.614	0.468
Neuroparalysis	1.221	0.400-3.732	0.726
Bleeding tendency	5.437	1.433-20.624	0.013
Decreased urine output	1.021	0.456-2.285	0.96
Mean platelet count (in lakh/mm3)	0.97	0.587-1.604	0.906
Mean PTTK (sec)	1.029	1.000-1.059	0.047
Mean Sr.creatinine (mg/dl)	1.056	0.901-1.238	0.503
Severe cellulitis	0.475	0.166-1.361	0.166
Respiratory failure	3.335	1.027-10.836	0.045
Severe coagulopathy	0.848	0.202-3.566	0.822
Shock	3.295	1.280-8.478	0.013
>2 complications	0.731	0.255-2.096	0.56
Mean ASV dose (cc)	0.998	0.997-0.998	<0.001

In the cohort of 65 patients displaying signs suggestive of neuroparalysis, ptosis was universally observed. Ophthalmoplegia manifested in 62 patients (95.4%), and 33 (50.7%) experienced respiratory distress. Within the survivor group, 35 patients (94.6%) had ophthalmoplegia, while the non-survivor group exhibited this symptom in 27 patients (96.4%) (P = 0.727). Respiratory distress was noted in 9 survivors (24.3%) and 24 non-survivors (85.7%), revealing a statistically significant difference (P < 0.001).

Among the 64 patients diagnosed with acute renal failure, 46 (71.9%) experienced oliguria, 10 (15.6%) had anuria, and 8 (12.5%) progressed from oliguria to anuria. Oliguria was observed in 17 survivors (60.7%) and 29 non-survivors (80.6%) (P = 0.080). Anuria occurred in 6 survivors (21.4%) and 4 non-survivors (11.1%) (P = 0.259). Oliguria followed by anuria was present in 5 survivors (17.9%) and 3 non-survivors (8.3%) (P = 0.282)

The clotting time averaged 13.76 ± 3.21 minutes. Significant coagulopathy was identified in 77 patients based on PT and PTTK assessments. Acute renal failure (ARF) was observed in 80 (30.8%) patients, and 77 (29.6%) patients exhibited a propensity for bleeding. All 80 ARF patients displayed albuminuria. Laboratory investigations for patients with both acute renal failure and coagulopathy are presented in Table 3, while Table 4 outlines the various complications.

ISSN:0975 -3583,0976-2833 VOL15, ISSUE 02, 2024

DISCUSSION

In studies conducted in hospital settings, mortality rates varied from 3%[13] to 20%[14,15]. Several authors have identified significant factors contributing to the death of patients in such settings, including delayed hospital arrival (prolonged bite-to-hospital time),[7,16‑18] respiratory failure,[4,7,17,19‑21] acute respiratory failure (ARF),[4,7,9,15,20] severe coagulopathy or disseminated intravascular coagulation (DIC),[6,7,9,20] and shock[15,19,22]. However, only a limited number of studies have undertaken statistical analyses to evaluate predictors of mortality.[4,5]

The higher incidence of snakebite cases in rural areas observed in this study may be attributed to the substantial number of people engaged in fieldwork, particularly in activities such as paddy cultivation, and the common practice of walking barefoot.[8] Mud-built houses in rural areas provide both access and shelter to snakes.[2] The prevalence of cases in rural areas may also be influenced by habits such as sleeping on the floor, outside the house, or in farms. Nevertheless, no significant correlation was found between mortality and the patients' residential area (rural/urban). Kulkarni *et al*. (1994) [19] reported that 90% of cases were from rural areas, while Naik *et al*. (1997)[15] found that 83.6% of cases originated from rural areas. Sharma *et al*. (2005)[13] identified a rural-to-urban ratio of 4.7:1, which was higher than the ratio observed in our study group. We also identified a correlation between the duration from snakebite to hospital admission and mortality. This association has been consistently observed in various studies, where a delay in reaching the hospital is linked to increased complications and mortality rates [4, 5,7,13,18]. The explanation for this correlation lies in the direct relationship between the incidence of complications and the time venom remains in the bloodstream before being neutralized by antivenom serum (ASV). Late arrival at the hospital leads to a prolonged duration of venom activity, increasing the risk of complications and subsequent mortality [18].

No correlation was observed between the timing of snake bites (day/night) and mortality. The higher incidence of bites during daytime can be attributed to increased outdoor activities during that period, leading to a greater likelihood of encountering snakes and, consequently, snake bites. Kulkarni *et al*. (1994) [19] reported that 68.2% of cases involved daytime bites. In contrast to our findings, Sharma *et al*. (2005) [13] noted that 60.6% of bites occurred at night.

CONCLUSIONS

In our findings, we assert that the prognosis of mortality in individuals suffering from snake bites can be foreseen through uncomplicated variables such as the presence of bleeding tendencies, respiratory failure, and shock. These predictive factors offer valuable assistance to healthcare practitioners in peripheral health centers, enabling them to anticipate outcomes. Consequently, high-risk cases can be promptly directed to advanced facilities for specialized management, eliminating unnecessary delays after administering essential initial treatments, including the initial dose of Anti‑snake venom (ASV). Therefore, it is imperative to ensure the availability of Anti‑snake venom (ASV) at all Primary Health Centers (PHCs). Simultaneously, raising awareness among the general populace about the importance of avoiding unnecessary procedures, such as consulting traditional healers, and promptly transporting patients to hospitals can significantly contribute to improved outcomes.

ISSN:0975 -3583,0976-2833 VOL15, ISSUE 02, 2024

REFERENCES

1. Sarangi A, Jena I, Das JP. A Profile of snakebite poisoning with special reference to hematological, renal, neurological, electrocardiographic abnormalities. J Assoc Physicians India 1977;25:555‑60.
2. Kasturiratne A, Wickremasinghe AR, de Silva N, Gunawardena NK, Pathmeswaran A, Premaratna R, *et al*. The global burden of snakebite: A literature analysis and modelling based on regional estimates of envenoming and deaths. PLoS Med. 2008 Nov 4;5(11):e218.
3. Warrell DA. Guidelines for the clinical management of snakebites in the South East Asian regions. Southeast Asian J Trop Med Public Health 1999;30:1‑84.
4. Kalantri S, Singh A, Joshi R, Malamba S, Ho C, Ezoua J, et al. Clinical predictors of in‑hospital mortality in patients with snakebite: A retrospective study from a rural hospital in central India. Trop Med Int Health 2006;11:22‑30.
5. Sharma SK, Chappuis F, Jha N, Bovier PA, Loutan L, Koirala, S. Impact of snake bites and determinants of fatal outcomes in southeastern Nepal. Am J Trop Med Hyg 2004;71:234‑8.
6. Kularatne SA. Epidemiology and clinical picture of the Russell's viper (Daboia russelii russelii) bite in Anuradhapura, Sri Lanka: A prospective study of 336 patients. Southeast Asian J Trop Med Public Health 2003;34:855‑62.
7. Suchithra N, Pappachan JM, Sujathan P. Snakebite envenoming in Kerala, South India: Clinical profile and factors involved in adverse outcomes. Emerg Med J 2008;25:200‑4.
8. Denker BM, Brenner BM. Azotemia and urinary abnormality. In: Fauci AS, Kasper DL, Longo DL, Braunwald E, Hauser SL, Jameson JL, Loscalzo J , editors. Harrison's Principles of Internal Medicine. 17th ed. New Delhi: McGraw Hill; 2008. p. 271.
9. Srimannanarayana J, Dutta TK, Sahai A, Badrinath S. Rational Use of Anti‑snake venom (ASV): Trial of various regimens in hemotoxic snake envenomation. J Assoc Physicians India 2004;52:788‑93.
10. Arruda V, High KA. Coagulation disorders. In: Fauci AS, Kasper DL, Longo DL, Braunwald E, Hauser SL, Jameson JL, Loscalzo J . editors. Harrison's Principles of Internal Medicine. 17th ed. New Delhi: McGraw Hill; 2008. p. 729‑30.
11. Coagulation Disorders. In: Firkin F, Chesterman C, Penington D, Rush B, editors. de Gruchy's Clinical haematology in Medical Practice. 5thed. India: Blackwell Science Ltd.; 1997. p. 406‑53.
12. Maier RV. Approach to the patient with shock. In: Fauci AS, Kasper DL, Longo DL, Braunwald E, Hauser SL, Jameson JL, Loscalzo J. editors. Harrison's Principles of Internal Medicine. 17th ed. New Delhi: McGraw Hill; 2008. p. 1689‑95.
13. Sharma N, Chauhan S, Faruqi S, Bhat P, Varma S. Snake envenomation in a north Indian hospital. Emerg Med J 2005;22:118‑20.
14. Sharma SK, Khanal B, Pokharel P, Khan A, Koirala S. Snakebite‑reappraisal of the situation in Eastern Nepal. Toxicon 2003;41:285‑9.
15. Naik RS, Tirpude BH, Khajuria BK. Mortality and morbidity pattern in snake bite at MGIMS Sevagram, Wardha: A rural area. Indian Pract 1997;50:31‑5.

16. Kulartane SA. Common krait (bungarus caeruleus) bite in Anuradhapura, Sri Lanka: A prospective clinical study 1996‑98. Postgrad Med J 2002;78:276‑80.
17. Looareesuwan S, Viravan C, Warrell DA. Factors contributing to fatal snake bite in the rural tropics: Analysis of 46 cases in Thailand. Trans R Soc Trop Med Hyg 1988;82:930‑4.
18. Narvencar K. Correlation between timing of ASV administration and complications in Snake bites. J Assoc Physicians India 2006;54:717‑9.
19. Kulkarni ML, Anees S. Snake venom poisoning, experience with 633 patients. Indian Paediatr 1994;31:1239‑43.
20. McGain F, Limbo A, Williams DJ, Didei G, Winkel KD. Snakebite mortality at Port Moresby General Hospital, Papua New Guinea, 1992–2001. Med J Aust 2004;181:687‑91.
21. Punde DP. Management of snake‑bite in rural Maharashtra: A 10‑year experience. Natl Med J India 2005;18:71‑5.
22. Paul V, Pratibha S, Prahlad KA, Earali J, Francis S, Lewis F. High‑ dose anti‑snake venom versus low dose anti‑snake venom in the treatment of poisonous snake bites: A critical study. J Assoc Physicians India 2004;52:14‑7.
23. Reddy KS. Organic irritant poisons. In: Essentials of forensic medicine and toxicology. 27th ed. Hyderabad: Laxmi Printers; 2008. p. 487‑99.
24. Hansdak SG, Lallar KS, Pokharel P, Shyangwa P, Karki P, Koirala S.A clinico‑epidemiological study of snake bite in Nepal. Trop Doct 1998;28:223‑6.
25. Steinmann L, Devkota UN, Shah LN. Snakebite in Nepal: A study from Siraha District. J Nepal Med Assoc 2000;39:203‑9.
26. Brunda G, Sashidhar RB. Epidemiological profile of snake‑bite cases from Andhra Pradesh using immunoanalytical approach. Indian J Med Res 2007;125:661‑8.
27. Gaitonde BB, Bhattacharya S. An epidemiological survey of snake‑bite cases in India. Snake 1980;12:129‑33.