e-ISSN: 0975-5160, p-ISSN: 2820-2651

Available online on www.ijtpr.com

International Journal of Toxicological and Pharmacological Research 2023; 13(12); 07-11

Original Research Article

A Retrospective Analysis of Clinical Profile of Snake Bite Victims in an Indian Tertiary Level Institute

Amitkumar Dilipkumar Modi[1], Komal Ravi Thaker[2], Harsiddh Thaker[3], Chandrashekhar Waghmare[4]

[1]Assistant Professor, Department of Forensic Medicine and Toxicology, GMERS Medical College, Vadnagar, Gujarat.

[2]Associate Professor, Department of Anesthesiology, Dr. N.D. Desai Faculty of Medical Science and Research, Dharmsinh Desai University, Nadiad, Gujarat.

[3]Assistant Professor, Department of Physiology, Dr. N.D. Desai, Faculty of Medical Science and Research, Dharmsinh Desai University, Nadiad, Gujarat.

[4]Associate Professor, Department of Forensic Medicine and Toxicology, Government Medical College., Satna, Madhya pradesh

Received: 28-11-2023 / Revised: 04-12-2023 / Accepted: 07-12-2023

Corresponding Author: Dr Chandrashekhar Waghmare

Conflict of interest: Nil

Abstract

Background and Objectives: Preventable mortality from snakebites hinges on timely intervention. In India, despite having a substantial number of venomous snakes and an ample supply of anti-venom, 50,000 deaths occur annually in 250,000 snakebite incidents. This alarming rate is attributed to the initial pursuit of unconventional remedies before seeking hospital care, highlighting the need for immediate medical attention. This study was done to evaluate the outcomes of individuals bitten by snake.

Methodology: We conducted a retrospective review of all patients admitted to the intensive care unit for the management of snake bite. The collected data encompassed variables such as age, gender, timing and month of the incident, bite location, anti-snake venom dosage, timing of anti-snake venom administration, duration of mechanical ventilation, complications, and mortality. We utilized Pearson's correlation test and paired samples t-test for statistical analyses.

Results: Out of a total of 156 patients, comprehensive data were retrievable for 79 snake-bite victims. The predominant snake type was the Krait. Males constituted the majority, with ages ranging from 20 to 40 years. A significant positive correlation was observed between lag time and the total anti-snake venom dose. Majority of patients required mechanical ventilation. Cardiac arrest, ventilator-associated pneumonia, and anti-snake venom reactions were observed. The overall mortality rate was 5.06%.

Conclusion: This study underscores the favourable outcomes for neurotoxic snakebite victims when promptly treated with anti-snake venom (ASV) and ventilator support. Delays in treatment or severe bites correlate with poorer outcomes. Adhering to national guidelines for ASV dosing proves effective in managing most cases.

Keywords: Snake Bites, Antivenom, India, Humans, Neostigmine.

Introduction

Preventable mortality ensues from snakebites when victims are not promptly treated. Despite India not hosting the highest number of venomous snakes globally and having an adequate supply of anti-venom, 50,000 fatalities occur annually in 250,000 snakebite incidents. The primary cause of this "unacceptable incidence" is the initial reliance on various "bizarre remedies" instead of seeking immediate hospital care [1].

Even qualified doctors sometimes struggle with unclear symptoms, leading to improper management of snakebite cases. Anti-snake venom (ASV) is frequently administered unnecessarily, potentially causing additional trauma due to severe side effects. Rural villagers often face challenges reaching a hospital within the crucial 10-minute window required for methods like pressure immobilization [2,3].

Recognizing this issue, the World Health Organization, in collaboration with leading Indian experts, is developing a "National Protocol" for snakebite management in India. Anil et al [4] recently conducted a prospective study aiming to streamline the management of snakebite victims in the Indian context.

In India, the most common snakebite involves Elapids (cobras and kraits), causing neurotoxic envenomation leading to muscle paralysis.

Bungarotoxins in neuroparalytic snake venom block acetylcholine receptors pre- and post-synaptically [5], deplete synaptic vesicles at synaptic sites [6], and induce structural damage to the motor end plate [7]. Polyvalent ASV can neutralize free-flowing snake venom but cannot reverse the block once the venom attaches to receptors [8]. Despite ASV administration, respiratory failure necessitates ventilator assistance for a variable duration, alongside supportive measures [7,9,10]. This retrospective analysis aims to assess the significant factors influencing the morbidity and mortality of snakebite victims admitted to a tertiary care hospital in India.

Material and Methods

A retrospective analysis was conducted on the management of snake bite cases in a tertiary care Indian hospital. Data were sourced from the record-keeping registers maintained by nurses and the central record-keeping section. Patient confidentiality was preserved by abstaining from mentioning personal identifiers such as names, registration numbers, and dates of birth, with patients being coded alphabetically.

Subsequently, all snake bite victims were identified from the archived data by one of the researchers and documented on an Excel sheet. Various parameters were then recorded for each patient. The initial data categorization comprised three main groups: victims who were brought in already deceased, victims referred to other hospitals due to bed unavailability, and victims managed initially in casualty and subsequently transferred to the ICU.

Further analysis focused exclusively on data from patients in Group C, admitted to the ICU after initial management in the casualty. The following parameters were scrutinized: count of patients admitted with a documented history of snake bites, count of patients undergoing cardiac or respiratory arrest, site of the snake bite, presence or absence of observable bite marks, nature of the snake bite, duration between the snake bite and the administration of Anti-Snake Venom (ASV) (lag time), past occurrences of mild reactions to ASV, incidences of life-threatening reactions following ASV administration, such as hypotension and bronchospasm, total dose of ASV administered, mean duration of mechanical ventilation, occurrence of complications during the ICU stay (e.g., ventilator-acquired pneumonia, acute renal failure, etc.), fatality rate. To categorize the severity of snake bites, the classification used by Ahmed SM et al. [10] was utilized as a reference.

Results

Predominantly, participants fell within the 20-40 years age group, with a male predominance. The extremities were the most frequent site of snakebites, and visible bite marks were evident in the majority of cases. The average lag time was approximately 5 hours, and the snake type was identified in a significant number of instances (Table 1).

In 54.43% of cases, severe envenomation was observed, with males constituting the predominant victims, as indicated in Table 2. The average lag time ranged from 5 to 6 hours, the duration of mechanical ventilation required was 58 hours, and the necessary anti-snake venom (ASV) dose was approximately 12 vials, as outlined in Table 3.

The top three prevalent complications included cardiac arrest, the requirement for mechanical ventilation (MV), and ventilator-associated pneumonia (VAP), as detailed in Table 4. A significant positive correlation was observed between lag time and the total anti-snake venom dose.

Table 1: Clinico-demographic parameters of study participants

Parameters	n	%
Total No. of patients	79	100.00
Age < 20 years	15	18.99
Age 20-40 years	41	51.90
Age >40 years	23	29.11
Male	55	69.62
Female	24	30.38
Bite marks present	54	68.35
Bite marks absent	25	31.65
Bite on extremities	39	49.37
Bite on central body	15	18.99
Type of snake known	43	54.43
Type of snake not known	36	45.57
Lag time (mean ± SD) in hours	5.8 ± 1.2	

Table 2: Severity of envenomation in snake bite cases

Parameters	Mild	Moderate	Severe
Total No. of patients	9	27	43
Age < 20 years	3	5	7
Age 20-40 years	5	12	24
Age >40 years	2	9	12
Male	7	17	31
Female	2	9	13
Bite marks present	5	17	32
Bite marks absent	5	9	11
Bite on extremities	4	12	23
Bite on central body	1	5	9

Table 3: Severity of bites in relation to lag time, mechanical ventilation and ASV dosage

Parameters	mild	moderate	severe	Total
Lag time	6.4 ± 1.8	5.7 ± 1.1	4.9 ± 1.3	5.8 ± 1.2
Duration of MV (hours)	27.1 ± 4.2	32.5 ± 5.3	112.3 ± 40.7	58.6 ± 15.3
ASV dose in vials (mean ± SD)	7.2 ± 1.5	10.1 ± 2.5	20.3 ± 3.0	11.8 ± 2.2

Table 4: Occurrence of Complications in snake bite cases as per severity of bites

Parameters	mild	moderate	severe	Total
Cardiac arrest	1	0	7	8
Need for MV	1	4	43	48
VAP	0	0	7	7
ASV Reactions	1	1	3	5
Hypotension	1	1	4	6
Acute Renal Failure	1	0	3	4
Mortality	0	0	4	4

Table 5: Correlation between lag time and total ASV dosagef

	Lag time	Total ASV
Lag Time		
r value	1	0.956
p value	-	<0.05
Total ASV		
r value	0.956	1
p value	<0.05	-

Discussion

In this retrospective examination, a predominant demographic of the affected individuals comprised young adult males residing in the peripheral villages surrounding the district town. This observed male preponderance aligns with the findings of preceding investigators [4, 9]. In the Indian context, where men typically serve as the primary breadwinners, engaging in outdoor work and sleeping in farmyards during harvesting emerged as plausible contributors to this gender bias. Moreover, in the northern regions of the country, migrant men constitute the majority of agricultural labor [4], often residing in dormitory accommodations and sleeping on the floor without their families. The prevalent manifestation of neurotoxic envenomation among the victims was notable, with a recurring history of early morning bites during sleep. This distinctive presentation, characterized by the development of ptosis and blurred vision upon awakening, is reminiscent of krait bites. Kraits, being commonly found in close proximity to human habitats, tend to seek prey within the crevices of houses [4, 11]. While cobras also induce neurotoxic envenomation, their habitat predominantly encompasses fields, making men working in these areas more susceptible to bites.

The peak incidence of snake bites occurred between July and September, coinciding with the monsoon season in India. During these months, the flooding of snake dwelling areas prompts their emergence, inadvertently leading to human encounters. This temporal pattern concurs with previous reports [9, 12, 13]. Notably, fang marks were absent in a substantial 31.65% of patients, despite a positive bite history. This phenomenon was predominantly observed in krait victims, attributed to the minute size of krait teeth, where even a scratch can result in envenomation. Additionally, the lack of inflammation in krait bites may lead to oversight in identifying scratch marks [4]. The distribution of bite marks primarily on the extremities, contrary to some earlier studies [11-13], could be explained by the circumstances of the bites occurring during sleep. Minimal movements of the extremities during sleep might be misconstrued as a threat by the snake, triggering a defensive response.

A notable finding in this retrospective analysis pertained to the lag time, a parameter often overlooked in prior literature. While previous studies reported a time range of 0.5 to 10 hours [4, 11, 14], our study indicated a narrower lag time of 5-6 hours. This reduction may be attributed to increased awareness of snake bite treatment and the availability of medical facilities. Victims were expedited to the hospital without resorting to unconventional remedies, potentially influencing the observed lag time.

The primary management approach for neurotoxic snake bite victims involved the administration of Anti-Snake Venom (ASV) along with mechanical ventilation as supportive therapy. According to national protocols, an initial ASV dose of 10 vials (100 ml) is recommended, with a subsequent dose of 10 vials within 2 hours if there is no improvement. Additionally, a single dose of neostigmine along with atropine is administered [15]. Contrary to the national guideline, the ASV doses in our study ranged from 4 to 21 vials, with a mean dose of 11.8 ± 2.2 vials. This discrepancy stemmed from the absence of a well-established national protocol during the retrospective study period. Instead, our institution's protocol dictated ASV dosage based on the severity of the snake bite [16].

The mean ASV dose in our patients was lower than that reported in earlier studies. Harsoor et al. [14] reported a mean dose of 146 ml, considerably less than that reported by Agarwal et al. [9] and Sharma et al. [13]. The variation in ASV administration schedules could be attributed to the absence of a standardized national protocol during the retrospective study period. The retrospective nature of the study limited access to specific details regarding neostigmine administration. Although all patients received neostigmine empirically, the exact dose schedule and its impact on motor function improvement were not documented.

ASV administration was not without complications, with adverse drug reactions, specifically hypotension, recorded in 5 patients. Additionally, 7 patients experienced cardiac arrest, all successfully revived, but 4 subsequently developed acute renal failure. Mechanical ventilation was required for approximately 60% of patients, with durations ranging from 25 to 152 hours. This duration was notably higher than reported by Anil et al. [4], possibly due to the severity of envenomation in our patient cohort. Ventilator-associated lung infections necessitating prolonged support were observed in 7 patients.

Analyzing patients with severe envenomation revealed that those bitten in proximal body parts (head and neck) experienced more severe outcomes, including cardiac arrest, renal failure, and ventilator-associated pneumonia. These patients required higher ASV doses and prolonged mechanical ventilation.

While acknowledging the limitations of a retrospective analysis, such as incomplete or insufficient data, this study's strengths lie in identifying critical trends, common snake bite types, and factors influencing outcomes. These insights can inform hospital preparations and emphasize the importance of early hospital reporting, avoidance of unconventional remedies, and the risks associated with sleeping on the floor and in farmyards.

Conclusion

This retrospective review underscores the favorable outcomes for neurotoxic snake bite victims managed promptly with ASV and ventilatory support. Delays in treatment and increased bite severity correlate with worsened outcomes. The majority of victims can be effectively managed with ASV doses aligned with national guidelines. The role of neostigmine, while attempted, lacks well-established evidence.

References

1. Simpson ID, Norris RL. Snakes of Medical Importance in India: Is the Concept of the “Big 4” Still Relevant and Useful? Wilderness Environ Med. 2007;18(1):2–9.
2. Norris RL, Ngo J, Nohan K, Hooker G. Physicians and lay people are unable to apply pressure immobilisation properly in a simulated snakebite scenario. Wilderness Environ Med. 2005;16(1):16–21.
3. Howarth DM, Southee AS, Whytw IM. Lymphatic flow rates and first aid in simulated peripheral snake or spider envenomation. Med J Australia. 1994;161(12):695–700.
4. Anil A, Singh S, Bhalla A, Sharma N, Agarwal R, Simpson ID. Role of neostigmine and polyvalent antivenom in Indian common krait (Bungarus caeruleus) bite. J Infect Public Health. 2010;3(2):83–7.
5. Mebs D, Claus I, Harvey AL. Amino acid sequences and toxicities of snake venom components. In: Snake toxins. New York: Pergamon Press; 1991. p. 425–47.
6. Chiappinelli VA, Harvey AL. K-neurotoxins and α-neurotoxins: Effect on neuronal nicotinic acetylcholine receptors. In: Snake toxins. New York: Pergamon Press; 1996. p. 223–58.

7. Dixon RW, Harris JB. Nerve terminal damage by β-bungarotoxin. Its clinical significance. Am J Pathol. 1999;154(2):447–55.
8. Theakston RD, Phillips RD, Warrell DA, Galagade Y, Abeyseikera DT, Dissanayake P. Envenoming by the common krait (Bungarus caeruleus) and Srilankan cobra (Naja naja naja), efficacy and complication of therapy with Haffkine antivenom. Trans R Soc Trop Med Hyg. 1990;84(2):301–8.
9. Aggarwal PN, Aggarwal AN, Gupta D, Behera D, Prabhakar S, Jindal SK. Management of respiratory failure in severe neuroparalytic snake envenomation. Neurol India. 2005;49(1) :25–8.
10. Ahmed SM, Nadeem A, Islam MS, Agarwal S, Singh L. Retrospective analysis of snake victims in Northern India admitted to a tertiary level institute. J Anaesthesiol Clin Pharmacol. 2012 Jan-Mar;28(1):45-50.
11. Kularatne SA. Common krait (Bungarus Caeruleus) bite in Anuradhapura, Sri Lanka - a prospective clinical study 1996-98. Postgrad Med J. 2002; 78:276-80.
12. Kulkarni ML, Anees S. Snake venom Poisoning, experience with 633 patients. Indian Paediatr. 1994; 31:1239-43.
13. Sharma N, Chauhan S, Faruqi S, Bhatt P, Varma S. Snake envenomation in north Indian hospital. Emerg Med J. 2005; 22:118-20.
14. Harsoor SS, Gurudatta CL, Balabhaskar S, Kiranchand N, Bhosale R. Ventilatory management of patients with neuroparalytic envenomation. Indian J Anaesth. 2006; 50:452-5.
15. Government of India. National snake bite protocol. New Delhi: Health and Family Welfare Department; 2007.
16. Ahmed SM, Ahmed M, Nadeem A, Mahajan J, Choudhary A, Pal J. Emergency management of snakebite – Pearls from literature. J Emerg Trauma Shock. 2008; 1:97-105.
17. Bomb BS, Roy S, Kumawat DC, Bharjatya M. Do we need anti-snake venom (ASV) for the management of elapid ophitoxaemia. J Assoc Physicians India. 1996; 44:31-3.
18. Pawar DK, Singh H. Elapid snakebite. Br J Anaesth. 1987; 59:385-7.
19. Seneviratne U, Dissanayake S. Neurological manifestations of snakebite in Sri Lanka. J Postgrad Med. 2002; 48:275-8.