CASE PRESENTATIONS – PRÉSENTATIONS DE CAS

MEDICAL SCIENCES

OPEN ACCESS

CLINICAL MANAGEMENT AND OUTCOMES OF SNAKE ENVENOMATION: A CASE SERIES

Susan George JEEVAN[1], Selvaraj HEMALATHA[2], Munir AFREEN[1], Kumar ARBIND[3]

[1] Nandha College of Pharmacy, Tamil Nadu, India
[2] Faculty of Pharmacy, Karpagam Academy of Higher Education, Coimbatore, Tamil Nadu, India
[3] Government Erode Medical College and Hospital, Tamil Nadu, India

Corresponding author: Hemalatha Selvaraj, e-mail: sai2pp2012@gmail.com

https://doi.org/10.38045/ohrm.2025.2.06 CZU: 616-001.49:598.115+615.373.39

ABSTRACT

Introduction In tropical rural communities, snakebite envenomation is among the main causes of morbidity and mortality. It results in shock, hemorrhage, tissue necrosis, and swelling. Diagnosing and identifying snake species is challenging, necessitating thorough clinical assessments and point-of-care tests. Hence this case series examines follow up on the course of clinical care and management of snake envenomation cases in Erode District, India, a location known for poisonous snakes such as the spectacled cobra *(Naja naja)*, Russell's viper *(Daboia russelii)*, and common krait *(Bungarus caeruleus)*.

Materials and methods This case series summarizes the hospital experience of patients with snake envenomation who were hospitalized to a local government medical college and hospital.

Rezults Five patients were confirmed or suspected of having been envenomated by a snake. Four patients received antivenom. The regional venom response team offered management guidance and antivenom. One patient's hospitalization was protracted and worsened by respiratory failure and corneal dystrophies. All patients survived and were discharged.

Conclusions This series emphasizes the necessity of early and comprehensive management measures to reduce morbidity and mortality from snake envenomation, as well as the need for ongoing research and interventions to improve patient care in a variety of clinical settings.

Keywords Envenomation, antivenoms, snake venom, clinical care, snakebite management.

GESTIONAREA CLINICĂ A MUȘCĂTURILOR DE ȘARPE VENINOS: O SERIE DE CAZURI

Introducere În comunitățile rurale tropicale, mușcătura de șarpe veninos este una dintre principalele cauze ale morbidității și mortalității. Aceasta duce la șoc, hemoragii, necroză tisulară și edem. Diagnosticarea și identificarea speciilor de șerpi reprezintă o provocare, necesitând evaluări clinice amănunțite și teste de diagnostic la unitatea medicală primară. Astfel, această serie de cazuri analizează evoluția clinică și gestionarea cazurilor de mușcături de șarpe veninos în districtul Erode, India, o zonă cunoscută pentru șerpii de acest fel, precum Cobra indiană *(Naja naja)*, Vipera lui Russell *(Daboia russelii)* și Krait-ul comun *(Bungarus caeruleus)*.

Materiale și metode Această serie de cazuri rezumă experiența clinică a pacienților mușcați de un șarpe veninos, care au fost spitalizați la un Colegiu medical guvernamental și spital.

Rezultate Cinci pacienți au fost confirmați sau suspectați că au fost mușcați de un șarpe. Patru pacienți au primit ser antiviperin. Echipa regională specializată a oferit ghidaj pentru gestionarea cazurilor și administrarea de ser antiviperin. Spitalizarea unui pacient a fost prelungită din cauza insuficienței respiratorii și a distrofiilor corneene. Ca rezultat, toți pacienții au supraviețuit și au fost externați.

Concluzii Acest studiu subliniază necesitatea unor măsuri de gestionare precoce și completă pentru a reduce morbiditatea și mortalitatea cauzată de mușcăturile de șarpe veninos, precum și necesitatea unor cercetări și intervenții continue, pentru a îmbunătăți îngrijirea pacienților în diverse situații clinice.

Cuvinte cheie Mușcătura de șarpe, ser antiviperin, venin de șarpe, îngrijire clinică, gestionarea mușcăturii de șarpe.

ABBREVIATIONS:

ALKP – alkaline phosphatase;
ASV – anti-snake venom;
Bp – blood pressure;
CBC – complete blood count;
CRP – C-reactive protein;
CKMB – creatine kinase-myocardial band;
CK – creatine kinase;
HB – hemoglobin;
INR – international normalized ratio;
LDH – lactate dehydrogenase;
MCH – mean corpuscular hemoglobin;
MCHC – mean corpuscular hemoglobin concentration;
MCV – mean corpuscular volume;
PR – pulse rate;
PLT – platelet;
PT – prothrombin time;
RBC – red blood cell;
RBS – random blood sugar;
SGOT – serum glutamic-oxaloacetic transaminase;
SGPT – serum glutamic pyruvic transaminase;
SpO_2 – oxygen saturation;
WBC – white blood cell;
WBCT – whole blood clotting time;
WHO – World Health Organization.

INTRODUCTION

Snakebite is a major public health concern, especially in tropical and subtropical regions, with high morbidity and mortality rates. Every year, nearly 5 million snake bites occur worldwide, resulting in 20,000-25,000 mortalities (1). India, with its great biodiversity, has the highest incidence of snakebite-related mortalities, with estimates ranging from 35,000 to 50,000 each year (2). India's snake species include highly venomous snakes such as the spectacled cobra (*Naja naja*), Russell's viper (*Daboia russelii*), and the common krait (*Bungarus caeruleus*). These snakes are responsible for a considerable fraction of envenomations, which result in a variety of clinical symptoms such as neurotoxicity, hemotoxicity, and cytotoxicity (3,4). Snake venom is a complex combination of enzymes, proteins, and peptides that can induce local damage to tissues, coagulopathy, neurotoxicity, and renal failure (5). Snakebite envenomation must be managed effectively using a multidisciplinary strategy that involves immediate antivenom delivery, supportive care, and complications treatment. Antivenom therapy, produced from immunized animal plasma, is still the primary treatment option (6). The snake species responsible for the bite guides the choice of antivenom, necessitating accurate clinical examination and, in many cases, laboratory confirmation (7). Snakebites are common in Erode District, Tamil Nadu, with rural inhabitants frequently encountering venomous snakes. As per the international guidelines, the treatment of such snake envenomation is given in Appendix 2. The purpose of this case series is to describe and assess the clinical characteristics, diagnostic findings, treatment options, and outcomes of snakebite patients treated at Erode government medical college and hospital. By evaluating these cases, we seek to emphasize the difficulties in managing snake bites and make recommendations for improving patient treatment and outcomes in comparable settings.

CASE SERIES DESCRIPTION

Case 1: Suspected Krait Snake Bite

A 32-year-old female patient was admitted to the hospital with complaints of a snake bite over the right middle finger. The bitten snake was identified as krait. The patient was having complaints of severe pain, cellulitis, and swelling over the right hand around the fang marks. On examination, the patient was conscious, oriented, afebrile, and obeyed oral commands. Her vitals and laboratory parameters were found to be normal, as given in Ta-

ble 3. It was noted that Whole Blood Clotting Time (WBCT) was less than 20 mins and there was an absence of coagulopathy. Initially, the patient was administered Iv-line, Inj. Tetanus toxoid, Inj. Ceftriaxone 1 g for prevention and treatment of infection, and Inj. Ranitidine 50 mg as ulcer prophylaxis. T. paracetamol 500 mg and T. serratiopeptidase 10 mg were also administered for the management of pain and inflammation on the right hand. Anti-Snake Venom (ASV) was not administered to the patient. It was observed that cellulitis, edema, and severity of snake bite decreased by the next day. The patient was discharged on the 5th day of presentation. The clinical profiling, vitals, and laboratory parameters are given in Tables 1, 2, and 3 respectively.

Case 2: Probable Cobra Snake Bite

A 67-year-old male patient was admitted to the hospital with the reported history of a snake bite over the left foot dorsum. The patient was having complaints of giddiness, drooping of eyelids, and dyspnoea. The bitten snake identified as a cobra. The patient had a history of chronic alcohol use for the past 30 years. On general examination, he was drowsy and ptosis was present. In view of the impending respiratory failure, the patient was incubated with 8-mm-size Endotracheal Tube (ET. Tube), bilateral air entry was checked and was connected to mechanical ventilator. He was administered with 10 vials of ASV in 100 mL Normal saline over 1 hour. As there was no recurrence of ptosis, Inj. Adrenaline, Inj. Atropine 0.6 mg, and Inj. Neostigmine 0.4 mg were administered. During the laboratory investigation, Creatine Kinase (CK) and Lactate Dehydrogenase (LDH) values were elevated, and all other parameters are normal, as given in Table 3. The patient was further managed by the administration of Inj. Ranitidine 50 mg, Inj. Hydrocortisone 100 mg, Inj. Ondansetron 4 mg, and T. Chlorpheniramine 4 mg. Inj. Thiamine 100 mg was administered as the patient was diagnosed with alcohol dependence syndrome. Days later, the severity decreased, and the patient was discharged on the 6th day of admission. The clinical profiling, vitals, and laboratory parameters are given in Tables 1, 2, and 3 respectively.

Case 3: Unknown Snake Bite

A 16-year-old male patient was admitted to the hospital with the history of a snake bite and presented with complaints of pain and bleeding at the bite site, headache, and vomiting. The bitten snake was unknown. The pain radiates from the leg to the thigh. On local examination, diffuse pitting edema was present in the left leg from foot to thigh. Warmth, tenderness, and pulsation were present at the dorsum of the foot. The patient has no other comorbidities. On general examination, the patient obeys oral commands, and hydration was fair. On systemic examination, the patient was normal. During the laboratory investigation, it was found that the platelets were increased and Mean Corpuscular Volume (MCV) was decreased. The prothrombin time (PT) and International Normalized Ratio (INR) value were found to be slightly increased in the patient mentioned in Table 3. Immediately after admission, the patient was administered with injection ASV 8 vials in 1-pint normal saline over 1 hour along with Inj. cefotaxime 1 g, Inj. ondansetron 3 mg, Inj. Paracetamol 750 mg, and Inj. Ranitidine 50 mg. The child developed abdominal pain and wheezing while receiving antivenoms, and epinephrine was administered to treat an anaphylactic reaction. On the next day, Inj. Metronidazole 500 mg and T. Serratiopeptidase 10 mg were added for management of infection, inflammation, and pain. By the 7th day of admission, the symptoms decreased, and the patient was discharged by the next day. The clinical profiling, vitals, and laboratory parameters are given in Tables 1, 2, and 3 respectively.

Case 4: Respiratory Failure and Corneal Dystrophies

A 25-year-old male patient was presented to the emergency department with an alleged history of snake bite over the left foot 30 minutes prior to the presentation. The snake was unknown. He complained of giddiness and difficulty breathing and swallowing. On local examination, there was swelling and cellulitis over the left foot, along with a bite mark. On general examination, he was found to be drowsy, irritable, and disoriented, along with traumatic scarring of the cornea. Primarily, he was hypertensive, and a systemic examination was found to be unremarkable. In view of impending respiratory failure, the airways were secured by endotracheal intubation and mechanical ventilation. He was diagnosed to have local and neurotoxic signs of envenomation and was administered with 10 vials of injection ASV, followed by administration of injection atropine 0.6 mg, injection neostigmine 0.5 mg, and broad-spectrum antibiotics. T. paracetamol 500 mg and T. serratiopeptidase 10 mg were further administered for the management of pain and swelling. The patient condition gradually improved and was discharged on the 5th day of presentation. The clinical profiling, vitals, and laboratory parameters are given in Tables 1, 2, and 3 respectively.

Case 5: Snake Wrangler Case

A 55-year-old male patient was admitted to the hospital with complaints of a snake bite on the right leg. Local examination shows pain and swelling at the bite site in the middle of the right leg and cellulitis till the knee joint. Primarily the patient was hypertensive; otherwise, the systemic examinations were unremarkable. During the laboratory investigations, Mean Corpuscular Hemoglobin Concentration (MCHC) was found to be slightly elevated, as all the renal, liver, and clotting parameters are as per given in Table 3. Initially, the patient was administered with 8 vials of anti-snake venom, followed by administration of inj. ceftriaxone 1 g, inj. ranitidine 50 mg, T. paracetamol 500 mg, T. serratiopeptidase 10 mg, and T. chlorpheniramine 10 mg. Days after the patient was found to be normal and stable and was discharged on the 6th day of presentation. The clinical profiling, vitals, and laboratory parameters are given in Tables 1, 2, and 3 respectively.

Table 1. Clinical profiling of all the cases.

Case	Medical Condition	Symptoms	Comorbidities	Clinical Profile	Biochemical Profile	ASV	Clinical Outcome
1	Suspected krait bite	Severe pain, cellulitis, swelling Fang mark Edema	-	Female, 32 years old	Normal CBC, elevated CRP	-	Discharged on 5th day
2	Probable cobra bite	Fang mark Giddiness, drooping eyelids, dyspnoea	Alcoholic dependence syndrome	Male, 67 years old	Elevated WBC, normal electrolytes	Given	Discharged on 6th day
3	Unknown snake bite	Pain, bleeding, vomiting, headache	-	Male, 16 years old	Anaemia, normal electrolytes	Given	Discharged on 8th day
4	Unknown snake bite	Swelling, cellulitis, Respiratory failure, drowsy, irritable, disoriented, giddiness, dyspnoea, dysphagia corneal dystrophies	-	Male, 25 years old	Normal CBC, elevated CRP	Given	Discharged on 5th day
5	Unknown snake bite	Pain, swelling	-	Male, 55 years old	Normal CBC, elevated CRP	Given	Discharged on 6th day

Table 2. Vitals of cases.

Vitals	Case 1	Case 2	Case 3	Case 4	Case 5
Blood pressure (Bp) (mmHg)	130/90	130/90	109/68	150/97	140/90
Pulse Rate (PR) (bpm)	90	86	76	97	90
SpO2 (%)	97	97	100	99	98

Table 3. Laboratory investigations.

Parameters	Case 1	Case 2	Case 3	Case 4	Case 5
HB (g/dL)	12.6	14.8	13	16.2	14.1
RBC (10^{12}/L)	3.7	4.8	5.0	3.9	3.3
WBC (10^{9}/L)	7.5	6.9	10.6	6.21	6.4
PLT (10^{9}/L)	285	249	301*	265	249
MCHC (g/dL)	34	35.9	37.8*	33.4	37.4
MCH (pg)	28	27.5	29.4	26.1 -*	31.2
MCV (fL)	81	76.9 -*	77.8 -*	78.1 -*	83.4
RBS (mg/dL)	96	98	107	154*	NA
UREA (mg/dL)	18	20	15	26	30
CREATININE (mg/dL)	0.7	0.8	0.7	0.9	0.8
TOTAL PROTEIN (mg/dL)	7.5	7.6	7.5	7	7
ALBUMIN (g/dL)	3.8	3.6	4.3	3.7	4.3
TOTAL BILIRUBIN (mg/dL)	0.3	0.3	0.4	0.6	1.1
SGOT (IU/L)	29	46*	20	21	46*
SGPT (IU/L)	26	40	14	15	46
ALKP (IU/L)	78	174	223	112	63
CK (U/L)	NA	209**	NA	NA	NA
CKMB (U/L)	NA	96**	NA	NA	NA
LDH (U/L)	NA	440**	NA	NA	NA
Na +(mmol/L)	NA	NA	NA	142	NA
K +(mmol/L)	NA	NA	NA	3 -*	NA
PT (Seconds)	NA	10 -*	19.5**	14*	10.2 -*
INR (Seconds)	NA	0.71 -*	1.49**	1.03	0.73 -*
WBCT (Minutes)	<20 min	<20 min	<20 min	=20	<20 min

-*: slightly decreased; *: slightly elevated; **: highly elevated; **NA**: not assessed

MATERIALS AND METHODS

A case series study on snake bites was conducted at a tertiary care teaching hospital to examine the clinical course, management, and outcomes of snake envenomation. The study was conducted at the hospital's emergency department and intensive care unit over a one-year period, from June 2023 to June 2024. A thorough proposal for this study was presented to the institutional ethics committee of the government erode medical college and hospital, and approval was granted (IEC/2023/013). The study covered a total of five patients.

The management protocol followed was based on the standard guidelines recommended by World Health Organization (WHO). This study included patients of all ages and genders with a confirmed or highly suspected snake bite. Patients having a history of allergic reaction to antivenom and patients with insufficient medical records were excluded from this study (patients were excluded if their medical records were incomplete or lacked essential information such as diagnostic results, treatment history, or follow-up data). Data were obtained from medical records, which included demographic information, clinical presentation, treatment provided, laboratory findings, and clinical outcomes. The flow of case study was represented in figure 1.

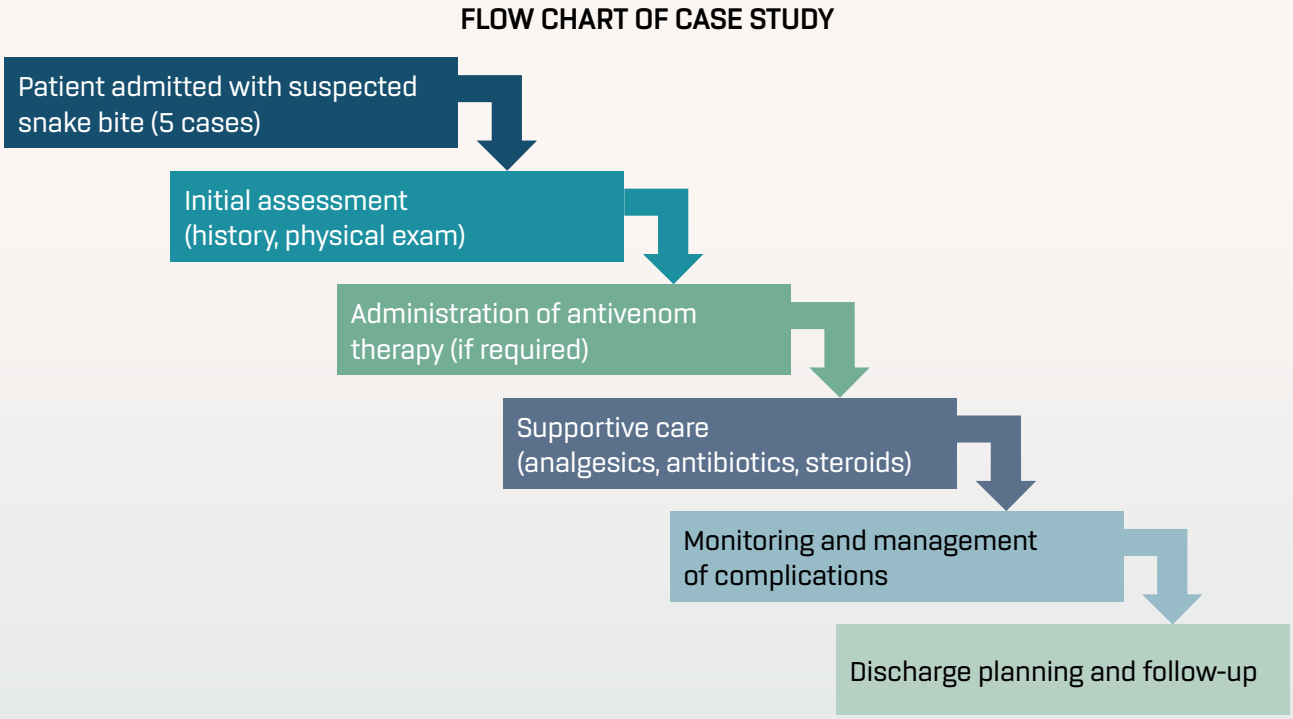

Figure 1. Chart of Case Series.

DISCUSSION

Snakebite remains a global health issue, with significant morbidity and mortality rates. Challenges in snake identification, particularly in rural settings, highlight the need for improved training and tools for accurate identification. First aid knowledge among the public is crucial for reducing complications. Most bites in this series affected the lower limbs, consistent with previous studies. The clinical signs and biochemical markers observed align with known effects of snake envenomation. The administration of antivenom, although associated with allergic reactions in some cases, remains the definitive treatment. Supportive care and patient-specific interventions are

essential for managing complications and comorbidities. The role of clinical care in optimizing treatment protocols and patient outcomes is significant. Snake envenomation remains a significant health problem globally, with substantial morbidity and mortality. The WHO estimates that over 5 million people are bitten by snakes each year, resulting in 20,000 to 25,000 mortalities, predominantly in rural and underserved populations (8). India, with its rich biodiversity, accounts for the highest number of snakebite-related mortalities globally, with estimates ranging between 35,000 and 50,000 deaths annually (9). This alarming statistic underscores the urgent need for effective management strategies and public health interventions to mitigate the impact of snakebites, particularly in rural and agricultural communities where the risk is highest (10).

The primary goal of snakebite management is to neutralize venom toxins and mitigate complications through the timely administration of antivenom. Polyvalent antivenoms, which target multiple venom components, are the standard treatment for snake envenomation in India (11). However, the use of antivenom is not without challenges, including the risk of hypersensitivity reactions and serum sickness. Despite these risks, antivenom remains the most effective treatment for snakebites, significantly reducing mortality and morbidity when administered promptly (12).

The clinical presentation of snake envenomation varies widely depending on the species involved, the amount of venom injected, and the site of the bite. Common symptoms include local pain and swelling, systemic manifestations such as nausea, vomiting, and neurological deficits, and laboratory abnormalities indicative of coagulopathy and organ dysfunction (13). Accurate identification of the offending snake species can be challenging, particularly in regions with high snake diversity and limited resources for species identification. This underscores the need for a high index of suspicion and a broad approach to management in areas where multiple venomous species are endemic (14).

CASE SERIES ANALYSIS

Case 1: Suspected Krait Snake Bite

In this case, the patient presented with localized symptoms of pain and swelling without systemic manifestations. The decision not to administer antivenom was based on the absence of systemic symptoms and normal biochemical parameters, including a whole blood clotting time of less than 20 minutes. The patient responded well to symptomatic treatment and antibiotics, highlighting the importance of clinical judgment in managing cases where the availability of antivenom is limited (15).

Case 2: Probable Cobra Snake Bite

This case involved a patient with significant systemic symptoms, including ptosis and respiratory difficulty, suggestive of neurotoxic envenomation likely from a cobra bite. The elevated levels of CK and LDH indicated muscle injury, which is consistent with cobra venom's known myotoxic effects. The administration of ten vials of antivenom resulted in a marked improvement in the patient's condition, emphasizing the critical role of antivenom in managing neurotoxic snakebites. The patient's mild residual ptosis at follow-up suggests partial recovery of neuromuscular function, which is a common outcome in neurotoxic envenomation (16).

Case 3: Unknown Snake Bite

In this case, the patient exhibited both localized and systemic symptoms, including bleeding and vomiting. The slightly prolonged PT and INR suggested a mild coagulopathy. The administration of eight vials of antivenom led to complete recovery, with no residual effects noted at one-year follow-up. This case underscores the importance of antivenom in managing both local and systemic effects of snake envenomation, even when the exact species is unknown (17).

Case 4: Respiratory Failure and Corneal Dystrophies

This patient presented with severe systemic symptoms, including respiratory failure and neurological deficits, indicative of a severe envenomation possibly from a cobra or krait. The development of corneal dystrophies as a complication is notable and highlights the need for comprehensive supportive care in managing the long-term sequelae of severe envenomation. The patient's prolonged hospital course and the need for respiratory support underscore the potential severity of neurotoxic snakebites and the critical role of antivenom in preventing fatal outcomes (18).

Case 5: Snake Wrangler Case

The patient in this case, a professional snake wrangler, experienced significant local reactions, including pain, swelling, and cellulitis, following a cobra bite. The timely application of a tourniquet and administration of antivenom and antibiotics resulted in a good outcome, with no residual effects at nine-month follow-up. This case highlights the importance of first aid measures and prompt medical intervention in reducing the severity of envenomation and preventing complications (19).

All the 5 cases were followed up and shown in appendix 1.

COMPARATIVE ANALYSIS

The outcomes observed in this case series are consistent with findings from previous studies conducted in India and other regions with high snakebite incidence. A study by S. Stephen et al. in Tamil Nadu reported a mortality rate of 2% among snakebite patients, with coagulopathy and renal failure being common complications (20). Another study by Halesha et al. in Karnataka found a 1.5% mortality rate, with neurotoxic symptoms and cellulitis frequently observed among snakebite victims (21). These findings shown in Table 4 underscore the variability in clinical outcomes and the critical role of timely and appropriate management in improving patient survival and recovery.

Table 4. Comparative Analysis with Previous Studies.

Study	Population	Common Snakes	Bites Analyzed	Antivenom Reaction Rate	Mortality Rate	Common Complications
Present Study	Erode District	Cobra, Krait, Russell's	5	20%	0%	Respiratory failure, cellulitis
S. Stephen et al. (2021)	Tamil Nadu	Cobra, Krait, Viper	100	15%	2%	Coagulopathy, renal failure
Halesha et al. (2013)	Karnataka	Cobra, Krait, Viper	75	10%	1.50%	Neurotoxic symptoms, cellulitis
Gupta et al. (2011)	Northern India	Cobra, Viper, Krait	50	12%	2.50%	Hemotoxic symptoms, infection

CONCLUSION

1. This case series highlights the diverse clinical presentations and outcomes associated with snake envenomation in Erode District, India.
2. The timely administration of antivenom, combined with supportive care and management of complications, is crucial in improving patient outcomes.
3. The variability in clinical manifestations and the challenges in species identification underscore the need for a multidisciplinary approach and ongoing research to optimize snakebite management protocols.

CONFLICT OF INTEREST The author does not declare any conflict of interest.

ETHICAL APPROVAL: A detailed proposal for this study was submitted to the institutional ethics committee of the government erode medical college and hospital, and approval was granted (IEC/2023/013).

ACKNOWLEDGEMENT: We would like to thank our principal and management of Nandha College of Pharmacy and Dean, Government Erode Medical College and Hospital for the professional support given in the Clinical Management and Outcomes of Snake Envenomation.

APPENDICES

Appendix 1. Follow-Up and Long-Term Outcomes.

Case No.	Follow-Up Duration	Residual Effects/Complications	Quality of Life Post-Discharge
1	6 months	None	Good
2	3 months	Mild ptosis	Fair
3	1 year	None	Excellent
4	6 months	Corneal dystrophies	Fair
5	9 months	None	Good

Appendix 2. Comparisons with International Guidelines.

Guideline	Recommendation	Present Study Findings
WHO Guidelines (2016)	Immediate antivenom administration	Administered within 2 hours of admission
Indian National Snakebite Protocol	Use of polyvalent antivenom	Polyvalent antivenom used in 4 cases except 1st case as there was no necessity to administer ASV.
UK Snakebite Management Protocol	Initial dose of 8-10 vials of antivenom	Doses of 8-10 vials used

REFERENCES

1. Di Nicola MR, Crevani M, Avella I, et al. A Guide to the Clinical Management of Vipera Snakebite in Italy. *Toxins (Basel)*. 2024;16(6):255. doi:10.3390/toxins16060255.
2. Gololo AA, Veettil SK, Anantachoti P, Taychakhoonavudh S, Patikorn C. Epidemiological models to estimate the burden of snakebite envenoming: A systematic review. *Trop Med Int Health*. 2025;30(2):71-83. doi:10.1111/tmi.14080.
3. Gajbhiye RK, Munshi H, Bawaskar HS. National programme for prevention & control of snakebite in India: Key challenges & recommendations. *Indian J Med Res*. 2023;157(4):271-275. doi:10.4103/ijmr.ijmr_2424_22.
4. Williams DJ, Faiz MA, Abela-Ridder B, et al. Strategy for a globally coordinated response to a priority neglected tropical disease: Snakebite envenoming. *PLOS Negl Trop Dis*. 2019;13(2):e0007059. doi:10.1371/journal.pntd.0007059.
5. Abdel-Kader S, Abbas IM, Abu-Zidan FM. Management of Animal Bites: A Global Perspective. In: Coccolini F, Catena F, eds. *Textbook of Emergency General Surgery*. Springer; 2023. doi:10.1007/978-3-031-22599-4_26.
6. Mackessy, S.P. *Handbook of Venoms and Toxins of Reptiles* (2nd ed.). CRC Press; 2021. doi: 10.1201/9780429054204.
7. Hamza M, Knudsen C, Gnanathasan CA, et al. Clinical management of snakebite envenoming: Future perspectives. *Toxicon: X*. 2021;11:100079. doi:10.1016/j.toxcx.2021.100079.
8. Afroz A, Siddiquea BN, Chowdhury HA, Jackson TN, Watt AD. Snakebite envenoming: A systematic review and meta-analysis of global morbidity and mortality. *PLOS Negl Trop Dis*. 2024;18(4):e001208. doi:10.1371/journal.pntd.0012080.
9. Gandham S, Jagtap AA. Temporal analysis of animal bite incidents in a tertiary care hospital in Western Maharashtra. Al Am een J Med Sci 2024; 17(3): 218-222.
10. Whitaker R, Captain A. *Snakes of India: The Field Guide*. Chennai, India: Draco Books; 2004. Available at: https://archive.org/details/snakesofindiafie0000whit. Accessed August 7, 2024.
11. Roberts N. Quantifying the mortality, health outcomes, and disability due to snakebite envenoming in India. [Dissertation]. University of Washington; 2020. Available at: http://hdl.handle.net/1773/45745. Accessed August 7, 2024.
12. Sriapha C, Rittilert P, Vasaruchapong T, Srisuma S, Wananukul W, Trakulsrichai S. Early Adverse Reactions to Snake Antivenom: Poison Center Data Analysis. *Toxins*. 2022;14(10):694. doi:10.3390/toxins14100694.
13. Ralph R, Faiz MA, Sharma SK, Ribeiro I, Chappuis F. Managing snakebite. *BMJ*. 2022;376:e057926. doi:10.1136/bmj-2020-057926.
14. Bolon I, Durso AM, Mesa S, et al. Identifying the snake: First scoping review on practices of communities and healthcare providers confronted with snakebite across the world. *PLOS ONE*. 2020;15:e0229989. doi:10.1371/journal.pone.0229989.
15. Stephen S, Mohanty CR, Radhakrishnan RV, et al. Clinico-Epidemiological Profile, Trends, and Health-Related Outcomes of Snakebite Victims: A One-Year Prospective Study from Eastern India. *Wilderness Environ Med*. 2024;35(2):155-165. doi:10.1177/10806032241239628.
16. Dheer SK, Lal R, Bhawani RK. A study of clinico-epidemiological profile of patients of snake bite and their outcome in a tertiary care centre in central zone of Himachal Pradesh. *Int J Res Med Sci*. 2023;11:1192-1196. doi:10.18203/2320-6012.ijrms20230860.
17. Hati AK, Mandal M, De MK, Mukherjee H, Hati RN. Epidemiology of snake bite in the district of Burdwan, West Bengal. *J Indian Med Assoc*. 2024;90(6). Available at: https://pubmed.ncbi.nlm.nih.gov/1522302/. Accessed August 7, 2024.
18. Warrell DA. Snake bite. *Lancet*. 2010;375(9708):77-88. doi:10.1016/s0140-6736(09)61754-2.
19. Jacobsen I, Mahadevan S. National Snakebite Management Protocol (India). 2008. Available at: https://kedarbhide.com/wp-content/uploads/2014/12/National-Snakebite-Protocol-highlighted.pdf. Accessed August 7, 2024.
20. Mandal A, Chakraborty M, Iyyadurai R, Gunasekaran K. Clinical Profile, Outcome, and Cost of Care in Snakebite Patients Requiring Admissions in a Single Medical Unit: A Retrospective Study from a Tertiary Care Center in South India. *Arch Med Health Sci*. 2023;11(2):190-193. doi:10.4103/amhs.amhs_51_23.
21. Karanth JB, Maribashetti K, Karanth G. Clinico-Epidemiological Study Done at a Tertiary Care Centre in Western Ghats of South India and Outcome of Snakebite Cases. *Int J Trop Dis Health*. 2023;44(18):33-39. doi:10.9734/ijtdh/2023/v44i181476.

Date of receipt of the manuscript: 09.08.2024

Date of acceptance for publication: 23.05.2025

Kumar ARBIND, SCOPUS ID: 57210737373