RESEARCH PAPER

Structural and Functional Impairment of Snake Bite in Adults from Rural Community: A Survey Study

Manali Avasare[1*], Dr. Mandar Malawade[2]

[1*]Final year student, Krishna College of Physiotherapy, Krishna Vishwa Vidyapeeth, Karad.

[2]Head of Department, Department of Pediatric Neurosciences, Krishna College of Physiotherapy, Krishna Vishwa Vidyapeeth, Karad-415539

Corresponding Author: Manali Avasare

ABSTRACT

Background: Snakebites, particularly in rural and tropical areas, are a major but often overlooked occupational and environmental health issue, causing around 125,000 deaths and 400,000 disabilities annually worldwide. Venomous snakes from families such as Elapidae, Viperidae, and Colubridae contribute significantly to these figures. In India, the "big four" snakes—Russell's viper, Indian cobra, saw-scaled viper, and common krait—are mainly responsible. The severity of a bite depends on multiple factors including snake species, victim's age, and amount of venom injected. Venoms contain a complex mix of toxins affecting the nervous, circulatory, and muscular systems, leading to neurotoxicity, tissue necrosis, kidney injury, and more. Despite the high burden, snakebite envenomation remains underrecognized globally. There is a strong need for better treatment access, public education, protective equipment, and rehabilitation services for survivors.

Methods: The structural and functional impairment of snake bite in adults from rural community are studied though survey. A cross-sectional study design included 61 participants. Data was collected with the help of a ICF. Institutional review board approval was gained and also informed consents were obtained from each participant.

Results: Among the 61 participants (21.31% Female, 78.68% Male), structural and functional impairments were primarily related to sensory and movement functions. While all participants had no impairments in mental, speech, and most internal body functions, mild sensory and skin impairments were universal. Neuromusculoskeletal issues were notable, with moderate impairments in muscle tone and power affecting a significant portion. Structural impairments in movement-related areas, particularly the upper extremities, were common, though most other body systems remained unaffected. Overall, impairments were concentrated in mobility and movement-related functions.

Conclusion: Snake bites cause significant structural and functional impairments in rural adults, often leading to long-term physical, psychological, and socio-economic challenges. Improving access to timely medical care, raising community awareness, and providing rehabilitation services are vital to reducing these impacts and improving survivors' quality of life.

Keywords: Structural Impairment, Functional Impairment, Snake Bite, Rural Community.

How to cite this article: Avasare M, Malawade M. Structural and Functional Impairment of Snake Bite in Adults from Rural Community: A Survey Study. Int J Drug Deliv Technol. 2026;16(16s): 466-471. DOI: 10.25258/ijddt.16.16s.49

Source of support: Nil.

Conflict of interest: None

INTRODUCTION

A common and often fatal occupational and environmental disease is snake bites, originating from a poisonous snake injecting a highly specific toxic fluid (venom) into a human, generally by mistake. The families Elapidae, Hydrophidae, Crotalidae, Colubridae, and Viperidae have a number of poisonous species. There are 224 species in 32 genera in the family Viperidae and 325 species in 61 genera in the family Elapidae. Additionally, There are about 700 poisonous species in the Colubridae, the most varied and extensively snakebite is still a relatively underappreciated source of unintentional fatality, particularly in rural areas. Age, patient size, snake species, number and location of bites, and the amount and toxicity of venom all affect how a snakebite victim presents clinically. Particularly in rural regions of tropical developing nations, snake bite is a prevalent and usually fatal occupational and environmental illness. Because of their abundance of protein and peptide toxins that are specific to a variety of tissue receptors, snake

**Author for Correspondence: manaliavasare03@gmail.com*

venoms are both therapeutically difficult and scientifically intriguing, particularly for medication development. In addition to non-protein poisons, carbohydrates, lipids, amines, and other tiny molecules, the venom of each species may comprise over 100 different hazardous and non-toxic proteins and peptides. They are divided into three categories based on toxicity: neurotoxic, hematotoxic, and locally toxic. Toxins that affect the circulatory, neurological, and hemostatic systems and result in tissue necrosis are the most significant in human envenomation. The Toxic effects of the venom, which Neurotoxins found in snake venom operate at several locations to either block or activate peripheral neuromuscular connections. Snake bite affects in various way, like local tissue damage, neurotoxicity, cardiovascular and haemostatic disturbances, acute kidney injury, Rhabdomyolysis etc. Local necrosis is the primary cause of long-term impairment in snake bite survivors. While amputation may be required if deep tissues are destroyed, large regions of skin necrosis require debridement and grafting. Long-term effects include malignant transformation, osteomyelitis, arthrodesis, and persistent ulceration. The research included every verified snakebite patient admitted to this medical facility, regardless of age or gender. Age, sex, employment, residence, registration number, biting time, bite location, and bite site were the sociodemographic variables that were examined. A thorough examination of the patient's medical history, symptoms, complications, and results was conducted. The age group was created from the patients: above 20 years adults. An estimated 5 million individuals worldwide are bitten by snakes each year, resulting in around 125 000 fatalities and 400 000 lasting disabilities or disfigurements. In India, the fatality rate from snake bites is equal to half of all fatalities from HIV/AIDS and one fifth of all deaths from malaria globally. People between the ages of 10 and 30 who live in the world's poorest, most rural locations, where medical services are few, are most commonly bitten by snakes. However, human deaths have only been attributed to five genera: boomslangs, twig snakes, keelback snakes, green snakes, and slender snakes. The main four—Russell's viper, Indian cobra, saw-scaled viper, and common krait—have historically been held responsible for nearly all snakebite fatalities in the Indian subcontinent. The majority of venoms include hyaluronidase, which explains why absorption is so quick. Proteases harm the vascular epithelium and induce local inflammation and necrosis. Phospholipase contributes to shock and bleeding by changing the permeability of membranes and releasing histamine.

Its hypotensive effects are caused by phosphodiesterase. Some viper venoms include esterases. Let Bradykinin go. The bitten limb's swelling and soft tissue necrosis, as well as any systemic or neurological symptoms, may dominate the clinical picture, depending on the kind of snake that caused the injury. Serine proteases, metalloproteinases, and C-type lectins—found in viper and colubrid venoms—have the ability to either procoagulant or inhibit platelet aggregation, which can lead to ischemic or hemorrhagic strokes. Why, therefore, hasn't snake bites been included on the global health agenda before, despite the fact that they inflict a great deal of suffering and kill or maim hundreds of thousands of men, women, and children annually. Enhance their effectiveness and affordability, but also to promote collaboration amongst auxiliary programs that offer protective gear and footwear to rural workforces; effective first aid strategies to communities; much-needed education and training for rural physicians and health workers; health centers with upgraded infrastructure, basic medication, and equipment packages; rehabilitation for individuals with disabilities; and access to prosthetic services for amputees.

Method

The cross-sectional study was carried out among 61 adults from rural community with snake bite. The study was carried out by ICF case sheet. ICF was used to study structural and functional impairment of snake bite in rural community. A case sheet was made which included name, age and gender, structural impairments, functional impairments. The study duration was 6 months. The random sampling method was used because of limited time. The collected data were analyzed by a statistician using an instat application. Chi-square test was used to analyze the questions. Data was collected from adults age above 20 years.

Inclusion Criteria

The study was conducted among adults with snake bite and age above 20 years from rural community. The data was collected from those who were willing to participate in the study. Both male and female participants are included in this study.

Exclusion Criteria

The research excluded adults with non-venomous snake bite.

Ethical Committee Approval

The approval for this study is gained from the Institutional Ethics Committee of Krishna Vishwa Vidyapeeth (Deemed to be University), Karad. Respondents were given a detailed explanation about the study which is to be conducted and inform consent was collected from each and every participant participating in this study. There was a volunteer involvement of all the respondents in this study whose confidentiality was thoroughly maintained.

RESULTS:

The International classification of functioning, disability and Health questionnaire was used to determine the structural and Functional Impairment of body of Snake victim. The response was obtained by sending offline and online Forms. The collected data were analyzed by a statistician using an instant application. Chi-square test was used to analyze the questions. There were in all 2 sections. A] Gender: Out of the total participants, 13 were Female (21.31%) and 48 were male (78.68%). B] Impairments of Body Structure:1. Mental Function: All 61 participants (100%) had no impairment. 2.Sensory Function: All 61 participants (100%) had mild impairment. 3.Voice and Speech Function: All 61 participants (100%) had no impairment. 4. Functions of Cardiovascular, Hematological, Immunological, and Respiratory Systems:48 participants (78.68%) had no impairment, while 13 participants (21.31%) had mild impairment. 5. Functions of Digestive, Metabolic, and Endocrine Systems:59 participants (96.72%) had no impairment and 2 participants (3.27%) had mild impairment. 6.Genitourinary and Reproductive Function: All 61 participants (100%) had no impairment. 7.Neuromusculoskeletal and Movement-Related Function: Muscle Tone:14 participants (22.95%) had moderate impairment; none had no or mild impairment. Muscle Power:15 participants (24.59%) had mild impairment and 14 participants (22.95%) had moderate impairment; none had no impairment. Muscle Tone (repeated entry, assumed different assessment):18 participants (29.5%) had mild impairment; none had no impairment.8. Functions of Skin: All 61 participants (100%) had mild impairment. C] Impairments of Body Function: 1. Structure of Nervous System: All 61 participants (100%) had no impairment. 2.Eye and Ear Related Structure: All 61 participants (100%) had no impairment. 3.Structures Involved in Voice and Speech: All 61 participants (100%) had no impairment. 4.Structures of Cardiovascular, Immune, and Respiratory Systems:60 participants (100%) had no impairment, and 1 participant (0%) was marked as not applicable. 5.Structures Related to Digestive, Metabolism, and Endocrine Systems: All 61 participants (100%) had no impairment. 6. Structures Related to Genitourinary and Reproductive Systems:60 participants (98.36%) had no impairment, while 1 participant (1.63%) had mild impairment. 7.Structures Related to Movement: Upper Extremity and Shoulder Region:36 participants (59.01%) had mild impairment; none had no impairment. Lower Extremity and Trunk:15 participants (24.59%) had mild impairment; none had no impairment. Hand Region:1 participant (1.63%) had mild impairment; none had no impairment. Leg Region:9 participants (14.75%) had mild impairment; none had no impairment.

TABLE 1.0

COMPONENT	SUBCATEGORY	FREQUENCY	PERCENTAGES
A) Gender	1)Male 2)Female	48 13	78.68 % 21.31 %
B] Impairments of body structure 1.MENTAL FUNCTION	0=No Impairment	61	100%
2. SENSORY FUNCTION	O = no impairment 1 = mild impairment	0 61	0% 100%
3. VOICE AND SPEECH FUNCTION	O = no impairment	61	100 %
4. FUNCTIONS OF CVS, HEMATOLOGICAL, IMMUNO	O = no impairment 1 = mild impairment	48 13	78.68 % 21.31 %

LOGICAL AND RESPIRATORY SYSTEM			
5.FUNCTIONS OF DIGESTIVE, METABOLIC, ENDOCRINE SYSTEMS	O = no impairment 1 = mild impairment	59 2	96.72 % 3.27 %
6. GENITOURINARY AND REPRODUCTIVE FUNCTION	O = no impairment	61	100 %
7. NEUROMUSCULOSKELETAL AND MOVEMENT RELATED FUNCTION A) Muscle tone b) Muscle power C) Muscle tone	O = no impairment 1 = mild impairment 2 = moderate impairment O = no impairment 1 = mild impairment 2 = moderate impairment O = no impairment 1 = mild impairment	0 0 14 0 15 14 0 18	0 % 0 % 22.95 % 0 % 24.59 % 22.95 % 0 % 29.50 %

8. FUNCTIONS OF SKIN	O = no impairment 1 = mild impairment	0 61	0 % 100 %
C] Impairments of body function 1. STRUCTURE OF NERVOUS SYSTEM	O = no impairment	61	100 %
2. EYE, EAR RELATED STRUCTURE	O = no impairment	61	100 %
3. STRUCTURES INVOLVED IN VOICE, SPEECH	O = no impairment	61	100 %
4. STRUCTURES OF CVS, IMMUNO, AND RESPIRATORY SYSTEM	O = no impairment 9 = not applicable	60 1	100 % 0 %
5. STRUCTURES RELATED TO DIGESTIVE, METABOLISM AND ENDOCRINE SYSTEM	O = no impairment	61	100 %
6. STRUCTURES RELATED TO GENITOURINARY AND REPRODUCTIVE SYSTEM	O = no impairment 1 = mild impairment	60 1	98.36 % 1.63 %
7. STRUCURES RELATED TO MOVEMENT A] Upper extremity and shoulder region B] Lower extremity and trunk	O = no impairment 1 = mild impairment O = no impairm	0 36 0 15	0 % 59.01 % 0 % 24.59 %

	ent		
		0	0 %
C] Hand region	1 = mild impairment	1	1.63 %
	O = no impairment	0	0 %
	ent	9	
D] Leg region			14.75 %
	1 = mild impairment		
	O = no impairment		
	1 = mild impairment		

Discussion:

In addition to the initial envenomation consequences, snake bites in adult populations in rural areas cause substantial structural and functional damage. Local tissue injury is a frequent structural outcome that frequently leads to compartment syndrome, necrosis, and cellulitis. Delays in receiving medical attention frequently make these problems worse, increasing the risk of long-term impairment, amputations, or irreversible deformities. When neurotoxic venom damages the nerve system, victims may have long-term functional deficits such decreased movement, persistent discomfort, or muscular weakening. These disabilities severely limit day-to-day functioning and professional potential, particularly in rural areas where manual work is essential to subsistence. Psychosocial effects are especially important since long-term impairment can result in reduced quality of life, stigma, and economic loss. The paucity of rehabilitative services and little knowledge of early first aid and treatment further exacerbate the load. In remote areas, improved availability to antivenom, prompt transportation, and qualified medical personnel are essential for reducing the short-term and long-term effects of snake bites on adult populations.

Conclusion:

The Structural and functional impairments resulting from snake bites remain a serious health burden among adults in rural communities. Delayed access to medical care, reliance on traditional remedies, and lack of rehabilitation services often lead to lasting physical damage such as amputations, chronic pain, and mobility issues. These structural injuries frequently translate into functional impairments that limit daily activities, reduce earning capacity, and diminish overall quality of life. Additionally, the psychological and social consequences, including anxiety, depression, and stigma, further exacerbate the impact. To reduce these long-term effects, there is a critical need for timely access to antivenom, community education on early treatment, and integrated rehabilitation programs. A coordinated effort involving healthcare systems, public policy, and community engagement is essential to address and prevent the disabling consequences of snakebite envenoming in rural populations.

Source of Funding: None
Conflict of Interest: None

References

1. Warrell DA. Snake bite. Lancet. 2010 Jan 2;375(9708):77-88. doi: 10.1016/S0140-6736(09)61754-2. Erratum in: Lancet. 2010 Feb 20;375(9715):640. PMID: 20109866.

2. Gutiérrez JM, Calvete JJ, Habib AG, Harrison RA, Williams DJ, Warrell DA. Snakebite envenoming. Nat Rev Dis Primers. 2017 Sep 14;3:17063. doi: 10.1038/nrdp.2017.63. Erratum in: Nat Rev Dis Primers. 2017 Oct 05;3:17079. doi: 10.1038/nrdp.2017.79. PMID: 28905944.

3. Patel S, Patel A, Ganjiwale J, Patel D, Nimbalkar S. The study of clinical profile and outcome of patients with snakebite in a rural community. J Family Med Prim Care. 2021 Apr;10(4):1661-1665. doi: 10.4103/jfmpc.jfmpc_1976_20. Epub 2021 Apr 29. PMID: 34123909; PMCID: PMC8144800.

4. Snake bite--the neglected tropical disease. Lancet. 2015 Sep 19;386(9999):1110. doi: 10.1016/S0140-6736(15)00247-0. PMID: 26461887.

5. Metkar, Gauri Shrikrishna1; Saraf, Shalaka Prakash2; Nagare, Mangala Rajesh3. Clinical Profile and Outcome in Snake Envenomation in the Maval Region of Western Maharashtra: A Rural Tertiary Health-care Hospital Experience. Indian Journal of Public Health 67(4):p 517-519, Oct–Dec 2023. | DOI: 10.4103/ijph.ijph_1337_22

6. Del Brutto OH, Del Brutto VJ. Neurological complications of venomous snake bites: a review. Acta Neurol Scand. 2012 Jun;125(6):363-72. doi: 10.1111/j.1600-0404.2011.01593.x. Epub 2011 Oct 15. PMID: 21999367.

7. Williams D, Gutiérrez JM, Harrison R, Warrell DA, White J, Winkel KD, Gopalakrishnakone P; Global Snake Bite Initiative Working Group; International Society on Toxinology. The Global Snake Bite Initiative: an antidote for snake bite. Lancet. 2010 Jan 2;375(9708):89-91. doi: 10.1016/S0140-6736(09)61159-4. PMID: 20109867.

8. Alirol, E., Sharma, S. K., Bawaskar, H. S., Kuch, U., & Chappuis, F. (2010). Snake bite in South Asia: a review. PLoS Neglected Tropical Diseases, 4(1), e603.

9. Williams, D. J., et al. (2011). The Global Snake Bite Initiative: an antidote for snake bite. The Lancet, 375(9708), 89–91. https://doi.org/10.1016/S0140-6736(09)61159-4

10. World Health Organization (WHO). (2016). Guidelines for the management of snake-bites (2nd ed.). https://apps.who.int/iris/handle/10665/249547

11. Gutiérrez, J. M., Calvete, J. J., Habib, A. G., Harrison, R. A., Williams, D. J., & Warrell, D. A. (2017). Snakebite envenoming. Nature Reviews Disease Primers, 3, 17063. https://doi.org/10.1038/nrdp.2017.63

12. Bawaskar, H. S., & Bawaskar, P. H. (2004). Snake bite poisoning. Journal of the Association of Physicians of India, 52, 128–13

13. Kasturiratne, A., et al. (2008). The global burden of snakebite: a literature analysis and modelling based on regional estimates of envenoming and deaths. PLoS Medicine, 5(11), e218. https://doi.org/10.1371/journal.pmed.0050218

14. Pandey, D. P., Subedi Pandey, G., Devkota, K., & Goode, M. (2016). Public perceptions of snakes and snakebite management: implications for conservation and human health in southern Nepal. Journal of Ethnobiology and Ethnomedicine, 12(1), 1–12. https://doi.org/10.1186/s13002-016-0085-0

15. Habib, A. G., Gebi, U. I., & Onyemelukwe, G. C. (2001). Snake bite in Nigeria. African Journal of Medicine and Medical Sciences, 30(3), 171–178.

16. Silva, A., & Gunawardena, P. (2020). Chronic health complications following snake envenoming in rural Sri Lanka: a population-based study. PLoS Neglected Tropical Diseases, 14(12), e0008933. https://doi.org/10.1371/journal.pntd.0008933

17. World Health Organization (2019). Snakebite Envenoming: A Strategy for Prevention and Control. https://www.who.int/publications/i/item/9789241515641

18. International Federation of Red Cross and Red Crescent Societies (IFRC). (2020). Snakebite Envenoming in South Asia: A Review of Data, Challenges, and Opportunities.

19. Sharma, S. K., Chappuis, F., Jha, N., Bovier, P. A., & Loutan, L. (2004). Impact of snake bites and determinants of fatal outcomes in southeastern Nepal. The American Journal of Tropical Medicine and Hygiene, 71(2), 234–238. https://doi.org/10.4269/ajtmh.2004.71.234

20. Ahmed, S. M., Ahmed, M., Nadeem, A., Mahajan, J., Choudhary, A., & Pal, J. (2008). Emergency treatment of a snake bite: pearls from literature. Journal of Emergencies, Trauma and Shock, 1(2), 97–105. https://doi.org/10.4103/0974-2700.43191