Review Article

https://doi.org/10.3329/cbmj.v14i2.83325

Snakebite in Bangladesh: Public Health Challenges and Awareness Initiatives

*Sarkar SR[1], Ray NC[2]

Abstract

Snakebite envenoming presents a significant public health challenge in Bangladesh, particularly affecting rural and underserved populations. Infections resulting from snakebites compound medical complications, leading to increased morbidity and mortality. In this article, focuses on the complex public health challenges associated with snakebite infections in Bangladesh and emphasize the importance of awareness initiatives. Snakebites often occur in remote areas with limited access to medical care, resulting in delayed treatment and an increased risk of infections at the bite site. Secondary infections, caused by various pathogens introduced by the snake's fangs or subsequent wound contamination, further worsen the health burden. Common bacterial pathogens include Staphylococcus spp., Streptococcus spp., and various Gram-negative bacteria, which can lead to severe systemic infections if not promptly and adequately treated. The challenges in addressing snakebite infections are exacerbated by a lack of healthcare infrastructure, limited availability of antivenoms, and insufficient training among healthcare providers. Additionally, socio-economic factors and cultural beliefs often result in a reliance on traditional healers, delaying effective medical intervention. To tackle these issues, public health initiatives must prioritize increasing community awareness about the dangers of snakebites and the importance of timely medical treatment. Educational campaigns should target the general population and healthcare workers, emphasizing first-aid measures, the need for rapid hospital referral, and proper wound care to prevent infections. Strengthening healthcare systems, ensuring the availability of antivenoms, and conducting epidemiological research, and increasing awareness and implementing targeted interventions are crucial steps toward mitigating the impact of snakebite infections.

CBMJ 2025 July: vol. 14 no. 02 P:201-207

Keywords: Snakebite, Envenomation, Public Health, Challenges, Bangladesh, Awareness

Introduction

Snakebites are a critical yet often neglected public health issue in many tropical and subtropical regions, including Bangladesh. The country's agrarian lifestyle, dense rural population, and high prevalence of venomous snakes such as Russell's viper (Daboia russelii) contribute to the significant incidence of snakebite cases.[1,2] Globally, at least 421,000 envenomings and 20,000 deaths occur each year due to snakebite.[3] Due to its high human density, extensive agricultural practices, abundance of poisonous snake species, and dearth of effective snake bite prevention initiatives, South Asia is the most severely afflicted region in the world.[4] We explore the public health challenges posed by snakebite infections in Bangladesh and highlights various initiatives aimed at raising awareness and improving management.

Bangladesh records thousands of snakebite cases annually, with estimates ranging from 4,000 to 6,000 per year. The true number is likely higher due to underreporting and reliance on traditional healers. According to a postal survey carried out in 21 of Bangladesh's districts, the annual incidence is estimated to be 4.3 per 100,000 people, with a 20% case fatality rate.[5] Rahman *et al*. reported that snakebites account for considerable morbidity and mortality in rural areas, with a significant number of victims being farmers, fishermen, and children.[6]

Snakebites are more prevalent in certain regions, particularly the northern and southwestern parts of

1. *Dr. Santana Rani Sarkar, Associate Professor, Department of Microbiology, Netrokona Medical College (NMC), Netrokona.
2. Dr. Nitai Chandra Ray, Assistant Professor, Department of Nephrology, Community Based Medical College & Hospital, Bangladesh (CBMCH, B).

Address of Correspondence:
Email: dr.santanasarkar@gmail.com

Bangladesh. These areas are characterized by rice paddies, wetlands, and forests—ideal habitats for snakes.[7] The monsoon season further exacerbates the situation as flooding drives snakes into human settlements. High-risk populations include agricultural workers, who often encounter snakes while working in fields, and children, who are more vulnerable due to their smaller body size and lack of awareness.[6]

Types of Snakes Present in Bangladesh

Bangladesh is home to a diverse array of snake species, both venomous and non-venomous, due to its varied habitats ranging from forests and grasslands to wetlands and rivers.[8] Venomous snakes include the Indian Cobra (Naja naja), Monocled Cobra (Naja kaouthia), Common Krait (Bungarus caeruleus), Banded Krait (Bungarus fasciatus), Russell's Viper (Daboia russelii), Saw-scaled Viper (Echis carinatus), and various sea snakes like the Yellow-lipped Sea Krait (Laticauda colubrina) and Beaked Sea Snake (Enhydrina schistosa).[9] Non-venomous species include the Indian Python (Python molurus), Rat Snake (Ptyas mucosa), Checkered Keelback (Xenochrophis piscator), Sand Boa (Eryx conicus), Asian Water Snake (Homalopsis buccata), and the Brahminy Blind Snake (Indotyphlops braminus). Effective snakebite management and conservation efforts are critical, as understanding and protecting these species while reducing human-wildlife conflicts can improve public health outcomes and preserve biodiversity.[10]

Russell's Viper: Our Recent Concern

Russell's viper (Daboia russelii) is one of the most dangerous venomous snakes found in South Asia, including Bangladesh. Its potent venom can cause severe local and systemic effects, making it a significant public health concern in recent years.[11]

Russell's viper typically grows to about 1.2 meters in length but can reach up to 1.6 meters. It has a robust, stocky body with a distinct pattern of dark brown or black oval spots bordered by white or yellow on a background of tan or light brown. It is commonly found in rural and agricultural areas and prefers open, grassy or scrubby areas, but can also be found in forests, plantations, and even near human settlements. Viper venom is known for its potent necrotizing effects and its vasculotoxic properties, making it particularly dangerous to the circulatory system.[11,12] When injected, this venom can cause severe local tissue damage, leading to bleeding and potentially interfering with the body's clotting process. Among vipers, the Russell's viper stands out as one of the most venomous species, even surpassing the king cobra in terms of toxicity. The venom of the Russell's viper has been measured to contain up to 268 mg of venom, making it a formidable threat to any potential victims.[12]

Clinical and Microbiological Aspects of Snakebite

The clinical presentation of snakebite envenomation varies depending on the species involved. Russell's viper, one of the most dangerous snakes in Bangladesh, causes severe local and systemic effects. Local symptoms include pain, swelling, and necrosis at the bite site. Systemic effects can be life-threatening and include coagulopathy, acute kidney injury, and hemorrhage. According to Gutlerrez *et al*., untreated envenomation can lead to fatal complications such as disseminated intravascular coagulation (DIC) and shock.[13]

Secondary infections are a common but often overlooked consequence of snakebite wounds. The puncture wounds inflicted by snake fangs can introduce environmental bacteria into the body,

leading to infections. Common pathogens identified in snakebite wounds include *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and *Klebsiella spp*. These infections complicate the clinical course and can result in chronic wound infections, sepsis, and increased mortality if not adequately treated.[14]

Diagnosis and Treatment

Diagnosing snakebite envenomation and associated infections can be challenging, particularly in rural areas with limited medical facilities. Proper identification of the snake species is crucial for effective treatment but is often hindered by the lack of resources and expertise.[15] Diagnostic methods include clinical assessment, laboratory tests to detect venom components, and microbiological cultures to identify secondary infections.[16]

The cornerstone of snakebite treatment is the administration of antivenom. However, the availability and distribution of antivenom in rural areas are often inadequate. To decrease the worldwide burden of snakebite envenoming, access to safe, efficient, and quality-assured antivenom solutions that are customized for endemic poisonous snake species is essential.[17]

Additionally, treating secondary infections requires appropriate antibiotic therapy. The rise of antibiotic resistance, as reported by the World Health Organization (WHO), complicates treatment further and underscores the need for judicious use of antibiotics.[18]

Using Antivenom in Snakebite

Administering antivenom is the main treatment for snakebite envenomation, especially bites from the Russell's viper (Daboia russelii). It is essential to ensure proper dosing and administration to effectively neutralize the venom, alleviate symptoms, and prevent complications. Antivenom stands as the sole effective antidote for snake venom.[18.19] Antivenoms, also referred to as antivenins, are developed using hyperimmune plasma obtained from donor animals like horses, sheep, and camels that have been immunized with venoms. The toxins present in snake venom stimulate an immune response in these donor animals, primarily directed towards those toxins and others with a similar structure.[17]

The appropriate dosage of antivenom can vary depending on the severity of envenomation, the patient's body weight, and regional guidelines. General recommendations for both adults and children are the initial dose typically falls between 1 to 2 vials (each vial containing a standard amount of antivenom, usually around 10 ml), regardless of body weight, as a starting point for mild to moderate envenomation. In cases of severe envenomation, the initial dose may be higher, ranging from 4 to 10 vials. If dosing is based on body weight, the initial dose can be estimated at approximately 0.1 to 0.2 vials per kilogram of body weight for mild to moderate envenomation. For severe cases, 0.3 to 0.5 vials per kilogram may be necessary. After the initial dose, the patient should be closely monitored for any signs of improvement or persistent symptoms. If symptoms such as coagulopathy, systemic toxicity, or local tissue damage persist, additional doses of 1 to 2 vials may be administered every 6 hours until clinical improvement is observed. In severe cases, up to 10 additional vials may be required, depending on the patient's response. The preferred method of administering antivenom is intravenously, as it ensures rapid distribution and onset of action. The antivenom is typically diluted in an appropriate volume of isotonic saline (e.g., 100-500 ml of 0.9% saline) and infused over 30 to 60 minutes. The rate of

infusion can be adjusted based on the patient's condition and the presence of any adverse reactions.[18,19]

The treatment of snake envenomation poses a challenge due to the significant limitations of antivenoms. Pre-treatment with antihistamines (such as diphenhydramine) and corticosteroids (like hydrocortisone) may be considered to reduce the risk of allergic reactions. It is crucial to continuously monitor vital signs, including blood pressure, heart rate, and respiratory rate, during antivenom administration.[18,20] Additionally, it is important to be vigilant for signs of anaphylaxis, such as rash, itching, difficulty breathing, and hypotension, and be prepared to manage them with epinephrine, antihistamines, and corticosteroids.[21,22] Patients should be closely observed for at least 24 to 48 hours after receiving antivenom to watch for any delayed reactions or recurrence of symptoms. Supportive care should be continued, including pain management, wound care, and treatment of any complications such as renal impairment or coagulopathy.[22]

Case Studies and Field Reports

Case Study 1: Rural Areas of Bangladesh: In a rural area of the northern part of Bangladesh, a 35-year-old farmer was bitten by a Russell's viper while working in his rice field. He initially sought help from a local healer, who applied herbal poultices to the wound. After three days of worsening symptoms, including swelling, severe pain, and fever, the farmer was taken to the nearest healthcare facility. By this time, he had developed a severe secondary infection, necessitating extensive antibiotic treatment and wound debridement. This case illustrates the critical need for immediate medical intervention and the risks associated with traditional treatments.[23]

Case Study 2: Urban Areas of Bangladesh: In contrast, a 10-year-old boy in Dhaka city was bitten by a snake while playing in his backyard. His family promptly took him to a hospital, where he received antivenom and antibiotics within hours of the bite. The boy recovered fully without complications, highlighting the importance of rapid medical response and the benefits of public awareness and accessibility to healthcare.[24]

Public Awareness and Knowledge

Despite the high incidence of snakebites, public awareness regarding appropriate first aid and medical treatment remains alarmingly low. A survey conducted by Faiz *et al*. revealed that only 30% of snakebite victims sought medical treatment from healthcare facilities. The majority relied on traditional healers and local remedies, which often delayed effective treatment and worsened outcomes.[25] Besides, cultural beliefs and misconceptions about snakebites significantly influence treatment-seeking behavior. Many people in rural areas believe in supernatural causes of snakebites or trust in traditional practices such as herbal remedies and rituals performed by shamans. These practices not only delay access to medical care but also increase the risk of complications. Public health education campaigns are needed to dispel myths and encourage prompt medical attention.[25]

Public Health Strategies and Initiatives

The Government of the People’s Republic of Bangladesh, in collaboration with various non-governmental organizations (NGOs), has launched several initiatives to improve snakebite management and raise awareness. Our Ministry of Health and Family Welfare, with support from WHO, has established snakebite treatment centers in high-

incidence areas and provided training for healthcare providers on the management of snakebite envenomation and secondary infections. NGOs such as the Bangladesh Rural Advancement Committee (BRAC) have been instrumental in conducting awareness campaigns and distributing educational materials to rural communities.

Community engagement is crucial for the success of public health initiatives.[10,26] Training local leaders and community health workers to educate the public about snakebite risks, first aid measures, and the importance of seeking prompt medical care can significantly improve outcomes. Programs that integrate snakebite management into the primary healthcare system are also being piloted, ensuring that even remote communities have access to essential services.[10,27,28]

Recommendations

Widespread public education campaigns are essential to inform people about the risks of snakebites, appropriate first aid measures, and the importance of seeking medical treatment. These campaigns should utilize various media, including radio, television, and social media, to reach a broad audience. Educational programs in schools can also play a vital role in raising awareness among children and their families.

Improving healthcare access, particularly in rural areas, is critical. This involves increasing the availability of antivenom and antibiotics, training healthcare providers in snakebite management, and ensuring that healthcare facilities are equipped to handle snakebite emergencies. Mobile health units and telemedicine services can also help bridge the gap in healthcare access in remote areas. Robust surveillance systems are needed to accurately track snakebite incidents, outcomes, and the prevalence of secondary infections. Promoting research on snakebite envenomation, secondary infections, and antibiotic resistance can lead to the development of more effective treatment protocols and public health strategies.

Conclusion

Snakebite infections pose a significant public health challenge in Bangladesh, particularly in rural areas. While progress has been made in raising awareness and improving treatment, much work remains to be done. By enhancing public education, improving healthcare access, and promoting research, it is possible to reduce the burden of snakebite infections and improve outcomes for those affected. Policymakers, healthcare providers, and communities must work together to address this critical issue and ensure that effective and timely treatment is available to all snakebite victims.

References

1. *Hossain J, Biswas A, Rahman F, Mashreky S, Dalal K, Rahman A. Snakebite epidemiology in Bangladesh—a national community-based health and injury survey. Health. 2016;8:479-86.*
2. *Alam ABMSA, Islam AKMMB, Jesmin H. Snake bite as a public health problem: Bangladesh perspective. BIRDEM Med J. 2015;5(1):24-9.*
3. *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;5(11):e218.*
4. *Alirol E, Sharma SK, Bawaskar HS, Kuch U, Chappuis F. Snake bite in South Asia: A review. PLoS Negl Trop Dis. 2010;4(1):e603.*
5. *Sarker M, Sarker N, Patwary S. Epidemiological survey of snakebite incidences in Bangladesh. Dhaka Univ J Biol Sci. 1999;8:53-68.*

6. *Rahman R, Faiz MA, Selim S, Rahman B, Basher A, Jones A, et al. Annual incidence of snake bite in rural Bangladesh. PLoS Negl Trop Dis. 2010;4(10):e860.*
7. *Chowdhury MAW, Varela S, Roy S, Rahman MM, Noman M, Müller J. Favourable climatic niche in low elevations outside the flood zone characterises the distribution pattern of venomous snakes in Bangladesh. J Trop Ecol. 2022;38(6):437-50.*
8. *Whitaker R, Martin G. Diversity and distribution of medically important snakes of India. In: Gopalakrishnakone P, Faiz A, Fernando R, Gnanathasan C, Habib A, Yang CC. eds. Clinical Toxinology in Asia Pacific and Africa. Dordrecht, the Netherland: Springer; 2015. p.115-36.*
9. *Pandey DP, Pandey GS, Devkota K, Goode M. Public perceptions of snakes and snakebite management: Implications for conservation and human health in southern Nepal. J Ethnobiol Ethnomed. 2016;12:22.*
10. *World Health Organization (WHO). Guidelines for the management of snakebites. 2nd ed. India: WHO; 2016. p.22-24.*
11. *Ahsan MF, Saeed MA. Russell's viper (Daboia russelii) in Bangladesh: Its boom and threat to human life. J Asiat Soc Bangladesh Sci. 2018;44(1):15-22.*
12. *Senji Laxme RR, Khochare S, Attarde S, Suranse V, Iyer A, Casewell NR, et al. Biogeographic venom variation in Russell's viper (Daboia russelii) and the preclinical inefficacy of antivenom therapy in snakebite hotspots. PLoS Negl Trop Dis. 2021;15(3):e0009247.*
13. *Gutiérrez JM, Williams D, Fan HW, Warrell DA. Snakebite envenoming from a global perspective: Towards an integrated approach. Toxicon. 2010;56(7):1223-35.*
14. *Huang LW, Wang JD, Huang JA, Hu SY, Wang LM, Tsan YT. Wound infections secondary to snakebite in central Taiwan. J Venom Anim Toxins Incl Trop Dis. 2012;18:272-6.*
15. *Hamza M, Knudsen C, Gnanathasan CA, Monteiro W, Lewin MR, Lausten AH, et al. Clinical management of snakebite envenoming: Future perspectives. Toxicon: X. 2021;11:100079.*
16. *Esmaeilishirazifard E, Usher L, Trim C, Denise H, Sangal V, Tyson GH, et al. Bacterial adaptation to venom in snakes and arachnida. Microbiol Spectr. 2022;10:e02408-21.*
17. *Potet J, Beran D, Ray N, Alcoba G, Habib AG, Iliyasu G, et al. Access to antivenoms in the developing world: A multidisciplinary analysis. Toxicon: X. 2021;12:100086.*
18. *World Health Organization (WHO). Guidelines for the management of snakebites. 2nd ed. India: WHO; 2016. p.128-62.*
19. *Williams DJ, Habib AG, Warrell DA. Clinical studies of the effectiveness and safety of antivenoms. Toxicon. 2018;150:1-10.*
20. *Alangode A, Rajan K, Nair BG. Snake antivenom: Challenges and alternate approaches. Biochem Pharmacol. 2020;181:114135.*
21. *Ralph R, Faiz MA, Sharma SK, Ribeiro I, Chappuis F. Managing snakebite. BMJ. 2022;376:e057926.*
22. *de Silva HA, Ryan NM, de Silva HJ. Adverse reactions to snake antivenom, and their prevention and treatment. Br J Clin Pharmacol. 2016;81(3):446-52.*
23. *Yoshimura K, Hossain M, Tojo B, Tieu P, Trinh NN, Huy NT, et al. Barriers to the hospital treatment among Bede snake charmers in Bangladesh with special reference to venomous snakebite. PLoS Negl Trop Dis. 2023;17(10):e0011576.*
24. *Siddique MAB, Rahman MM, Kabir AKMH, Mallik MU, Habibullah MH, Hassan MM, et al. Experience of managing snake bite cases in a medicine unit of tertiary care hospital in Bangladesh – A case series. J Med. 2020;21:72-6.*
25. *Faiz MA, Rahman MR, Das JC, Karim SA, Ahmed S, Foyez MAA. A comprehensive survey on snakebite victims and their health-seeking behavior in rural Bangladesh. Health Sci Bull. 2010;8(1):1-7.*
26. *Sharmin S, Nurunnabi ASM, Ashique SS, Jahan A, Begum M. Health literacy: Intervention and outcome in child healthcare in Bangladesh Community Based Med J. 2023;12(1):124-8.*

27. *Kadam P, Ainsworth S, Sirur FM, Patel DC, Kuruvilla JJ, Majumdar DB. Approaches for implementing society-led community interventions to mitigate snakebite envenoming burden: The SHE-India experience. PLoS Negl Trop Dis. 2021;15(2):e0009078.*

28. *Vaiyapuri S, Kadam P, Chandrasekharuni G, Oliveira IS, Senthilkumaran S, Salim A, et al. Multifaceted community health education programs as powerful tools to mitigate snakebite-induced deaths, disabilities, and socioeconomic burden. Toxicon: X. 2023;17:100147.*