Letter to Editor

Snakebite Envenoming and Associated Factors in an Indian Context

Sir,

Although there is a lack of clarity on the exact number of snakebites worldwide, it is estimated that about 5.4 million people get bitten every year with 2.7 million envenoming.\(^1\) The World Health Organization (WHO) defines snakebite envenoming as a potentially life-threatening disease that typically results from the injection of a mixture of different toxins (venom) following the bite of a venomous snake.\(^1\)

The phenomenon, neglected globally, is responsible for many avoidable deaths and disabilities. The highest numbers of envenomings are observed in low- and middle-income countries, with African nations leading the list followed by Asians and Latin Americans.\(^1\) Ironically, the greatest burden of snakebite envenomings occurs in settings where the health system is the weakest.\(^1\) Agricultural workers, farmers, women, and children are vulnerable, especially in low- and middle-income countries.\(^1\) India alone accounts for one-third of all snakebite deaths, with a large proportion of the victims being farmers.\(^1\) 49,000 people die every year due to snakebites in the rural parts of the country.\(^2\) Although polyvalent snake antivenom is available for common venomous snakes such as the Indian Cobra (\textit{Naja naja}), there is a scarcity of the medication as well as the diagnostic kits in the rural settings.\(^2\)

Difficulty in producing antivenoms, poor health infrastructure, underreporting of cases, and shortage of antivenom supply are some of the other factors that worsen the situation.\(^1\)

This article discusses the burden of snakebite envenomings in India in terms of lives affected as well as people at risk. Furthermore, it throws light upon the myriad of factors associated with snakebite envenoming in the country and the impact of the same in several domains. Finally, it builds upon the need to address the issue of envenoming and its health consequences.

The WHO categorized snakebite as a high-priority neglected tropical disease in 2017.\(^2\) In India, snakebites are an underestimated reason for accidental mortalities.\(^3\) About 60 species of venomous snakes dwell in the country with the potential of envenoming, which includes the infamous Spectacled Cobra (\textit{Naja naja}), Common Krait (\textit{Bungarus caeruleus}), Saw-scaled Viper (\textit{Echis carinatus}), and Russell’s Viper to name a few.\(^3\) The country has a potent distribution of snakes in almost every region. Due to the dependence of victims on traditional treatment and underreporting, the size of the burden is obscure, especially in rural areas where the instances of snakebites are maximum.\(^1\) Maximum deaths are not certified legally as they occur in homes in the absence of any qualified medical professional.\(^1\)

According to a study done by Mohapatra et al., 13 states, namely Uttar Pradesh, Andhra Pradesh, Bihar, Jharkhand, Odisha, Chhattisgarh, West Bengal, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Karnataka, and Tamil Nadu, share the maximum burden of the problem in India, and Andhra Pradesh witnesses the most incidence of deaths due to snakebite envenoming followed by Madhya Pradesh and Odisha.\(^3\)

In another study, it was found that the peak age group at risk is 15–29 years all across the country, with varying gender predispositions in different states.\(^3\) Agricultural workers, cattle herders, fisherfolks, hunters, working children, people living in poorly constructed housing, and people with limited access to education and healthcare are the high-risk groups of contracting envenoming in the country.\(^1\) The issue is especially grim in the case of pregnant women, who endure hemorrhage and miscarriage following snakebites.\(^1\) The nature and timing of work, the setting, living conditions, as well as the level of awareness affect the chances of encountering a venomous snake. Likewise, the numbers of snakebite-related deaths are significantly higher during the monsoon months.\(^3\) Apart from deaths, many victims live with permanent physical damage due to tissue necrosis, spat-venom ophthalmia, persistent nerve damage, and psychological ramifications.\(^1\) The damage depends on the type of snake, age of the individual, sex of the person, and the site of the bite.\(^2\) Further, the quickness of antivenom provision, effective treatment measures, and understanding the mechanism of action of the inflicted venom make a difference in the end.

A snake injects venom produced in the gland behind its eyes via its hollow fangs that act like a hypodermic needle.\(^2\) The venom is usually a mixture of different chemicals and is of three types; hemotoxic, neurotoxic, and cytotoxic.\(^2\) Hemotoxic venom interferes with the blood clotting mechanism and causes incessant bleeding which often leads to fatal hemorrhage, shock, and convulsions.\(^2\) Likewise, neurotoxic venom targets central nervous system causing paralysis, lock-jaw, and difficulty in breathing.\(^2\) Victims die due to respiratory failure as the muscles of respiration fail to function properly. Cytotoxic venom, however, affects the surrounding area of the bite, damaging the cells and tissues.\(^2\) More often than not, this leads to amputation of the part of the body. Snake venom also causes hypotension, tachycardia, vomiting, diarrhea, and kidney failure.\(^2\)

Snakebite-envenoming chances are dictated by several factors, such as the dwelling, nature of the work, place, gender, age, and awareness. Likewise, the chances of recovery are also
dependent on similar factors. According to a report published in the *BMJ*,[4] delayed or nonarrival of the victims at the nearest healthcare centers, shortfall of the required antivenom, and inadequate treatment provision at the healthcare centers are the prime reasons for the loss of lives due to snakebite envenoming. Furthermore, in most of the rural areas, people prefer traditional healing techniques which may be questionable at times. Moreover, the lack of competency among peripheral health workers to treat snakebite cases due to fear of not being able to manage the antivenom-associated adverse reactions adds to the problem.[4] As a consequence of the lack of enough focus on snakebite management in the medical curriculum, the quality of treatment available in peripheral health centers and hospitals is often inadequate which invariably affects the victim.

Therefore, it is of pivotal importance that the snake is identified in the case of snakebite which understandably is a difficult task. Identification of the species helps in the planning of antivenom selection and dosage, which is the most dependable treatment for snakebite.[5] Antivenoms should be tailored to the region and the species. In India, about 85% of the snake venom for the production of antivenom is extracted in Chennai, which understandably is ineffective in northern parts of the country.[5] Priyanka Kadam, the founder of the Snakebite Healing and Education Society states, “Collecting venom regionally and producing antivenom for that particular region could be done to make treatment more effective.”[6] Moreover, the polyvalent antivenom is limited to specific snakebites and does not protect from many species such as the hump-nosed pit viper (*Hypnale hypnale*).[5] Further, medical practitioners should prescribe antivenom only for poisonous snakes and not all cases of snakebites.[6] Therefore, a multisectoral approach needs to be considered to deal with this neglected domain in the country.

Despite progress being made in the healthcare sector of India over the past few decades, snakebite envenoming management remains to be one of the neglected healthcare issues. Largely due to incomplete reporting and inadequate management, there is a huge gap between the number of cases and those being successfully treated in the country. Although there is potential to extract venom and produce the life-saving antivenom, several administrative issues obscure it from being a reality. To add to that, a majority of the rural populace relies on traditional healing techniques, the plausibility of which can be questionable many times. Therefore, to say the least, the country needs to upscale efforts and measures to tackle the neglected domain of snakebite envenomings sustainably for a better tomorrow.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

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