

## EDITORIAL

# PUBLIC HEALTH IMPLICATIONS OF THE RE-EMERGENCE OF 'CHANDRABORA' OR 'ULOBORA' (RUSSELL'S VIPER) ENVENOMING IN BANGLADESH

MD. ROBED AMIN<sup>1</sup>, ANIRUDDHA GHOSE<sup>2</sup>, AKM FAZLUR RAHMAN<sup>3</sup>, ULRICH KUCH<sup>4</sup>, MD. ABUL FAIZ<sup>5\*</sup>

'Chandrabora', 'Ulobora' or Russell's viper (*Daboia russelii*) is a member of the snake family Viperidae and one of the eight medically important terrestrial snake species of Bangladesh.<sup>1</sup> It has been known as an important venomous snake in the region of present-day Bangladesh long before. Twenty-two snakebite cases that both happened in places that are in Bangladesh today (in Dinajpur, Nilphamari, Jashore, Khulna and Satkhira Districts) and may be attributed to 'Chandrabora' based on descriptions of symptoms and signs that are characteristic of the envenoming syndrome caused by *Daboia russelii* were recorded by Mr. P. Banerji in a book in 1929 where he described 1134 short case histories of snakebite from different areas of what was then British India.<sup>2</sup> The major immediate manifestations following an envenoming bite by Russell's viper include local swelling, bleeding from the bite site and other places, shock, Disseminated Intravascular Coagulation (DIC), acute kidney injury, acute pituitary/adrenal failure, and capillary leak syndrome.<sup>3</sup> The first proven case of Russell's viper envenoming in the contemporary period in Bangladesh occurred in Chapainawabganj, and the patient had been admitted to Rajshahi Medical College Hospital (RMCH), Rajshahi, in 2013. Interestingly, in the same year a similar case was found in Patuakhali.<sup>4</sup> Following up on these cases, one of us (U.K.) could get hold of a

dead specimen of Russell's viper in 2014 from the same locality of Chapainawabganj, successfully extracted venom from another Russell's viper from that area for further study, and cautioned that more cases of snakebite by this species would be found in coming years in that and adjacent areas.

Over the subsequent 10 years a gradually increasing number of cases of 'Chandrabora' bite was found amongst the rural farming communities in Bangladesh, and the presence of this species was confirmed by physical evidence in numerous geographical sites in 27 districts of Bangladesh (data from Venom Research Centre, Bangladesh (VRC,B), Fig. 1).<sup>1</sup> In a prospective record, Dr. Abu Shahin documented 235 cases (125 of them from Chapainawabganj district alone) admitted to RMCH from 2013 until June 2024 with 69 deaths (Abu Shahin, personal communication). A similar increasing number of cases was also found in Bangabandhu Medical College Hospital, Faridpur, and Dhaka Medical College Hospital, Dhaka (personal communication with the emergency room teams of both hospitals). While managing these cases, the clinical teams found that the patients traversed diverse routes before their late arrival to hospital, and most commonly had first sought pre-hospital treatment from traditional healers ('Ohza') instead of coming directly to the nearest Upazila Health Complex (UzHC). During the COVID-19

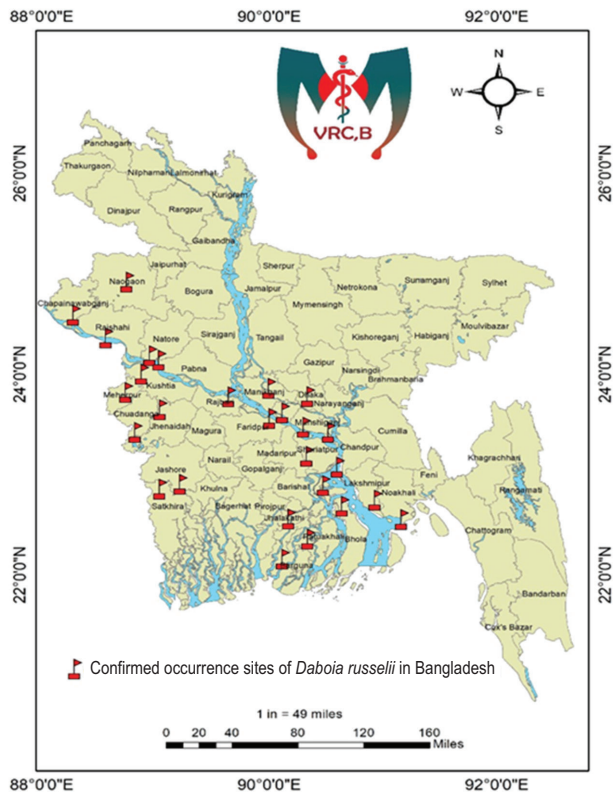
1. Professor of Medicine and Line Director, Non-Communicable Diseases, Directorate General of Health Services, Government of Bangladesh, Dhaka, Bangladesh
2. Professor of Medicine, Chittagong Medical College, Chattogram, Bangladesh
3. Executive Director, CIPRB, Dhaka, Bangladesh
4. Goethe University Frankfurt, Institute of Occupational, Social and Environmental Medicine, Frankfurt am Main, Germany
5. Dev Care Foundation, Bangladesh

\***Address of Correspondence:** Professor Md. Abul Faiz, Dev Care Foundation, Bangladesh, Phone: +8801713008858, Mail: drmafaiz@gmail.com

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**Figure 1:** Location of districts (n=27) in Bangladesh from where Russell’s viper was rescued by the team from Venom Research Centre (VRC), Bangladesh, in the years 2018-2023

pandemic one specific case of Russell’s viper envenoming was admitted at Noria UzHC, Shariatpur, where the patient received prompt treatment with polyvalent antivenom and was then referred to Dhaka. This patient developed acute coronary syndrome managed through a team approach and survived (presentation of the case in monthly snakebite training of NCDC, DGHS). However, the usual scenario observed was unfortunately that cases were referred to higher centres from UzHC without giving antivenom before referral, even if it was clearly indicated. This practice caused further delays in getting treatment which in turn resulted in poor outcomes.<sup>5,6</sup> On arrival in referral hospitals, such patients with Russell’s viper envenoming present with diverse manifestations (as stated above) and multiorgan involvement requiring critical care and posing a great burden on the patients’ families and the hospitals and their clinical teams.<sup>5</sup> Being a new emergency (critical) problem faced by the health care professionals, the latter were relatively uncomfortable managing the cases which at times also required complex and coordinated care. Survivors of Russell’s viper envenoming have been found to develop a variety

of complications like renal insufficiency and pituitary failure (at least three cases documented by the team of RMCH; Abu Shahin, personal communication).<sup>7, 8</sup>

Follow-up of the patients after Russell’s viper envenoming is yet to be institutionalized in low-resource settings of Bangladesh but crucial for detecting any physical and psychological long-term effects or disability.

Recent literature based on data modelling using temperature, rainfall, precipitation, vegetation, etc., has shown that snakebite is a ‘climate sensitive condition’ which will be changing its pattern, for example, due to increases or decreases in the geographical range of snake species which may even result in the appearance of species that had not been present before in a given country.<sup>9,10</sup> The apparent extension of the geographical range of Russell’s viper in Bangladesh was not unexpected because climatic conditions and habitats that are suitable for Russell’s viper have long existed in large parts of the country, and awareness of snakes and their observations (and their rapid broadcast via social media) as well as scientific research efforts have greatly increased in Bangladesh over the last decade. In addition, changes in land use such as crop cultivation, climate change effects that are already noticeable, and changes in the abundance of natural predators of Russell’s vipers all have the potential to influence the distribution and abundance of this species, and may well have done so during the same time period in Bangladesh. Furthermore, improved communication, health education, and better access to health care may have changed treatment seeking behaviours among the human population that is naturally exposed to these and other snakes. Thus, more cases of Russell’s viper envenoming from the already reported and other districts of Bangladesh are expected to seek treatment in coming years.<sup>1,4</sup>

The fact that the composition of snake venoms may vary greatly not only between species but also within species, for example, between different geographical populations of a snake species, is well known and documented. In a recent study, the venom of a Russell’s viper from Chapainawabganj district (Rajshahi Division, Bangladesh) was found to be different from the venom of the Russell’s vipers from southern India which is used for the production of the polyvalent antivenoms that are available in Bangladesh.<sup>3,11</sup> As a consequence, toxins in the venom of the Russell’s viper from Bangladesh were comparatively poorly recognized by these antivenoms.<sup>3,11</sup> To confirm that these differences exist between all Russell’s vipers in Bangladesh vs. those in other regions or countries,

and to detect any medically significant differences between the venoms of Russell's viper populations within Bangladesh, further studies of this kind need to be performed using the venoms of many individual Russell's vipers from across the country. However, the clinical experience in Bangladesh so far is congruent with these published findings in suggesting a low efficacy of the available polyvalent antivenoms made against the venom of southern Indian Russell's vipers and three other snake species. With the currently recommended initial dose of 10 vials of polyvalent antivenom, the mortality in patients who are admitted late to hospital is unacceptably high in comparison with data from neighbouring countries and even with the national average snakebite mortality in Bangladesh (20%). Although mortality in AKI due to Russell's viper bite found earlier in India is similar to our situation.<sup>7</sup> A dose-finding study to determine the adequate initial dose of the polyvalent antivenoms imported from India in Russell's viper envenoming in Bangladesh needs to be conducted as a priority action. The development of specific antivenoms for treating Russell's viper envenoming in Bangladesh, using the venoms of Russell's vipers from Bangladesh, should be fast-tracked to achieve the WHO target of reduction of snakebite mortality and disability by at least 50% by 2030. Until such new antivenoms become available in Bangladesh, existing antivenoms that are made against the venoms of Russell's vipers from countries other than India, and which have long been approved and on the market in those countries, should be evaluated in comparative pre-clinical and clinical studies to determine if they are perhaps more effective than the Indian polyvalent antivenoms against Russell's viper venom from Bangladesh. In addition, the possible benefit of small molecule inhibitors of certain groups of snake toxins that are important in Russell's viper venom, currently under study in other countries, should also be evaluated in pre-clinical and clinical studies in Bangladesh. Such studies should be prioritized when undergoing the necessary regulatory processes like ethical approval or permissions for the import, export and use of required research materials like snake venoms and antivenoms.

Russell's viper envenoming is a time-critical community emergency that requires prompt and multidisciplinary care in at least some patients. In snakebite patients who are admitted early, to predict who will need comprehensive care is often difficult since many bites are caused by non-venomous snakes, and Russell's viper bites like any other bite by a venomous snake can occur without the injection of venom. For managing snakebite including Russell's viper bites, one-stop 24/7 'Snakebite Clinics' may be established in major

referral hospitals following the model of the 'Snakebite Clinic' that was established two decades ago in Chittagong Medical College Hospital, Chattogram. Such a dedicated ward or clinic has been proven to be useful for delivering prompt, improved and coordinated care, providing training to health care professionals, and to facilitate documentation and research. The district hospitals in the high-risk areas (e.g., in Chapainawabganj) should be strengthened to provide respiratory support, dialysis and critical care. Such arrangements for one-stop service with dedicated beds with respiratory and renal care are also recommended in the National Action Plan for Prevention and Control of Snakebite Envenoming (NAPSE) of India.<sup>13</sup> Similarly, an early recommendation to set up such facilities for managing cases of severe malaria in district hospitals of the Chittagong Hill Tracts Districts is yet to be materialized.<sup>14</sup>

Despite the well-known fact that snake antivenom is an 'essential medicine' there are recurring problems related to access, timely availability and quality of antivenoms in low-resource settings, particularly where there is a reliance on imported antivenoms.<sup>15,16</sup> Continued availability of antivenom without stock-out and timely replenishment of antivenom and other medicines, consumables and equipment needed for managing snakebite envenoming by trained teams are prerequisites for optimum care. The procurement and distribution of antivenoms need innovation in supply-chain management and evidence-based need assessments for which proper recording of cases is required. Making snakebite a reportable disease may be an implementable option but requires policy decision as per the national strategy prepared.<sup>17</sup> Various long-term sequelae among the victims of snakebite including Russell's viper bite will only be detected and treated when there is a structured follow up. This, too, is yet to be arranged.

Managing the complex syndrome of envenoming caused by Russell's viper requires a series of fundamental skills by the health care team besides organizing care at different tiers of care and also during travel which needs transport having a skilled crew and paramedic. Most of these skills are generic and useful in a wide range of emergency health conditions. Thus, the re-emergence of Russell's viper envenoming in Bangladesh is also an opportunity to strengthen the health system as a whole. If we can manage such a day-to-day emergency well in peripheral facilities of the health care system, other conditions will follow the same path.

Community engagement is equally important to promote the provision of appropriate first aid, quick

transport to hospital without spending valuable time on seeking dangerous/useless traditional care, and at the same time for the prevention of snakebite. Community education on these topics should be considered as a priority and could be achieved through the involvement of multiple stakeholders including from the departments of health & family welfare, agriculture, local government, administration and forest, environment and climate change.<sup>18</sup> Involvement of civil society and non-government organizations, found in other public health conditions, is yet to become visible in Bangladesh for mitigating snakebite.

**Keywords:** Public health implications, re-emergence of 'Chandrabora' or 'Ulobora', Russell's viper, envenoming in Bangladesh

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