Case Report

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Neurotoxicity and acute renal injury secondary to Russell's viper bite in an individual: a case report from Nepal

Nabin Pahari[a], Bishnu Dhakal Sharma[b], Sagun Ghimire[d,*], Shanta Sharma[e], Bikram Kafle[f], Tekraj Upadhaya[g], Ahmed Al Montasir[c]

Introduction and importance: Owing to the high number of envenomation and fatalities, the Russell's viper holds greater medicinal significance than any other Asian serpent. South East Asia is one of the most snakebite-prone regions in the world. Dense population, extensive agricultural practices, the abundance of venomous snake species, and an overall lack of knowledge about primary treatment (first aid) are the major culprits associated with snake bite-related morbidity and mortality. The venom of vipers is known to produce vasculotoxicity and contains hemotoxins.

Case presentation: The authors describe a patient who was bitten by a viperine snake and showed signs of both neurotoxicity and acute kidney injury (AKI). The 20 years male was treated in a tertiary care centre in Nepal. The patient developed respiratory failure and needed ventilator support. Further, more haemodialysis was also done to manage AKI. Later, the patient was discharged after a smooth recovery.

Discussion: Numerous clinical manifestations, such as neurotoxicity and vasculotoxicity, can result from a viperine bite. The majority of viperine snakebites are hemotoxic. Dual neurotoxic symptoms are possible after a viperine bite despite their rarity. The prevention of respiratory failure depends critically on the early detection of neurotoxicity.

Conclusion: Unusual neuromuscular paralysis is caused by Russell's vipers (Daboia russelii) in South East Asia. Physicians should know the exceptional presentations of snakebites to diagnose and treat patients.

Keywords: case report, Nepal, neurotoxicity, phospholipase A_2, Russell's viper

Introduction

Snake envenomation is a critical tropical medical emergency in countries like Nepal. Among the world's 3400 snake species, Nepal has 89, with 17 being venomous[1,2]. The country sees around 20 000 snakebites annually, resulting in ~1000 deaths[3]. Although neurotoxic snakebites lead to high mortality, hemotoxic snakebites are also significant[4]. Russell's viper (*Daboia russelii*), primarily found in Nepal's Terai region, is notably hemotoxic but can exhibit neurotoxic and acute renal failure effects. As far our knowledge no documented cases of neurotoxicity and acute renal failure in the same person secondary to Russell's viper bite have been noted till date in Nepal. In terms of healthcare access regarding snake bite patients the countries of South Asia are placed in a low position due to the high burden of mortality and morbidity. Yearly the cases of snake bite victims are on the verge of the rise, but very minimal cases get into the light of reporting; hence no such public health alarming concern has been advocated. Our case report has been written in line with SCARE guidelines[5].

HIGHLIGHTS

- Owing to the high number of envenomation and fatalities, the Russell's viper holds greater medicinal significance than any other Asian serpent.
- The venom of vipers is known to produce vasculotoxicity and contains hemotoxins.
- The majority of viperine snakebites are hemotoxic. Dual neurotoxic symptoms are possible after a viperine bite, despite their rarity.
- Early recognition of envenomation and administration of antivenom is lifesaving.

Case Report

A 20-year-old male, student from a rural district of Nepal was bitten by a snake on his right foot while spraying pesticides on his sugarcane field around. According to the patient, the snake was

[a]Department of Intensive Care, Lumbini Provincial Hospital, [b]Department of Nephrology, Lumbini Provincial Hospital, Rupandehi, Nepal, [c]Department of Medicine,TMSS Medical College, Bangladesh, [d]Deaprtment of Neurosurgery, B and B hospital, Lalitpur, [e]Department of Community Medicine, Devdaha Medical College, Rupandehi, [f]Department of Psychiatry, Devdaha Medical College, Rupandehi and [g]Devdaha Medical College, Rupandehi, Nepal

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*Corresponding author. Address: B And B Hospital, Gwarko 44600, Lalitpur Nepal. Tel.: +984 6709 636. E-mail: sagunghimire01@gmail.com (S. Ghimire).

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half a metre long with egg-shaped marking on its body. The bitten site started bleeding, and he was taken to a snake charmer within 1 h of the snake bite. Snake charmer further advised the patient that no intervention is needed and the wound would heal on its own. The patient was then taken to home, but his pain didn't subside, and bleeding didn't stop. He was taken to a nearby hospital in a rural settings. In the hospital, IV line was secured, and he was immediately referred to a higher centre due to the unavailability of anti-snake venom.

In the higher centre Hospital, when he presented, he had ptosis in his both eyes. His blood pressure was 110/70 mmHg, pulse rate was 90 bpm, SpO_2 was 50% in room air. So, he was kept on non-rebreathing face mask on 15 l/ min of oxygen. His 20 min whole blood clotting test (WBCT) also came positive. He received 250 µg of subcutaneous adrenaline followed by 10 vials of polyvalent anti-snake venom. He had multiple blisters and swelling in the right foot (Fig. 1). Then he was shifted to intensive care.

His investigation revealed that white blood cell (WBC) 46 600/mm^3, haemoglobin (Hb) 8 gm/dl, Urea 170.7 mg/dl, creatinine 6.0 mg/dl, PT 29 sec, INR 2.41, serum creatinine kinase was 2800 U/l. On the second day of admission, he was tachypnoeic, and his oxygen saturation was also 70% in a non-rebreathing oxygen mask, so he was intubated and kept in a mechanical ventilator in VC/AC mode with proper sedation. He further received 10 vials of polyvalent anti-snake venom. He was in a state of shock and probable disseminated intravascular coagulation (DIC), so received three pints of fresh frozen plasma and 3 l normal saline to reduce further renal damage due to rhabdomyolysis. His urine output was decreasing from the first day of admission, and on a view of persistent oliguria, he received his first haemodialysis on fourth day from the snake bite. His ECG, chest X-ray and echocardiography had no significant findings. He even didn't have any significant past medical or surgical history. On fifth day of admission, he suddenly had a cardiac arrest, and after five cycles of CPR, there was the return of spontaneous circulation. He was extubated from mechanical ventilation on 11th day of admission. After three sessions of haemodialysis on 15th day of admission, his urine output was normal. He was strictly monitored for complete blood count, renal function test and urine output, and on 20th day he was transferred to the medical ward. He further stayed 4 days more in medical ward and on 24th day he was discharged home with proper wound healing of the bite site. On discharge his Hb = 8 gm/dl, urea 110 mg/dl, PT = 14 sec, INR = 1.1 Creatinine = 2.9 mg/dl, TLC = 16 000/ mm^3, platelets 300 000/mm^3, serum creatinine kinase 200 U/l. In subsequent follow-ups patient was hemodynamically stable, symptomatically better with normal blood investigations.

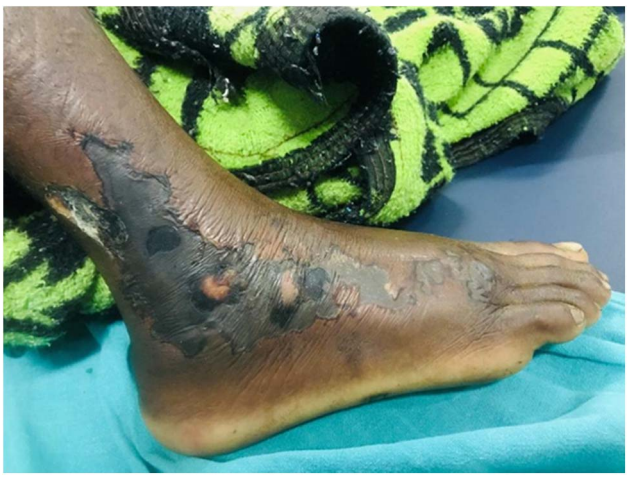

Figure 1. Multiple blisters formation on local bite site.

Discussion

Although Russell's viper is considered as hemotoxic it might also have some neurotoxic features. In research done by *Anjana Silva* and colleagues in 245 definite Russell's viper bite 68% had coagulopathy, 53% had neurotoxicity and 8% have oliguria. Neurotoxicity was characterised by ptosis (100%), blurred vision (93%) and ophthalmoplegia (90%)[6].

The exact cause of neurotoxicity in Russell's viper isn't known, but main role in it is said to be of phospholipase A_2(PLA_2) U1-viperitoxin-Dr1a[7]. This toxin interacts with the lipid bilayer of cell membrane of the nerve cell and changes the physical and chemical properties of the membrane, making it unstable, which makes synaptic vesicles difficult to fuse and release neurotransmitters effectively. Other toxins that might also cause neurotoxicity in minor roles are three finger toxins, Wagerins, Azemiopsin, Baptides, cysteine rich secretary proteins, Crotamine, Sarafatoxins[8].

Further, our patient had features of acute renal failure, which might be the consequence of rhabdomyolysis or coagulopathy and shock as postulated by Waikhom *et al.*[9].

Acute kidney injury, coagulopathy and neurotoxicity are the serious complications of Russell's viper envenomation and can be life-threatening in lack of proper haemodialysis, blood transfusion and mechanical ventilation facilities. This was the first documented case of Russell's viper bite with neurotoxicity and acute renal failure in the same individual in Nepal. A study done by Silva *et al.*[10] in Srilanka to determine clinical and pharmacological investigation of myotoxicity in Russell's viber which included 245 patients which showed potent involvement suggestive of neurotoxicity and myotoxicity. Snake bite is predominantly a condition of the rural tropics with 97% of snake bite deaths occurring in rural areas of South Asia[11]. There is tendency of snake bite patients frequently presenting to snake charmers and quack doctors before seeking care from qualified medical professionals hence resulting in timely diagnosis and management. Moreover, in developing countries, among the total snake bite cases, a very minimal number of patient's visits to tertiary care centre for prompt treatment[12]. Despite global development in anti-snake venom the countries of south Asia and mostly Nepal, have to face poor access to anti-snake venom in rural areas of the country, resulting in delays in getting urgent care, hence high chances of multi-organ damage and mortality. Moreover the countries development in the field of toxicology is very poor compared to developing countries due to a lack of advanced resources; hence, the rise of mortality from snakebites is still persistent in the country. Acute kidney injury due to snakebite is considered one of the common complications of hemotoxic snakebites like Russell viber and may ultimately need renal supportive therapy, which may not be available in resource-poor

setting. Early recognition of envenomation and administration of antivenom is lifesaving. However, in the majority of cases antivenom itself may not be sufficient to treat this devastating condition as seen in our patient. Therefore, timely referral of patients with anticipated AKI to centre with renal support therapy is needed. To the best of our knowledge, this is the first case report of concurrent nephrotoxicity and neurotoxicity related to Russell's viper envenoming in Nepal.

Conclusion

Snakebite among the citizens of South Asian countries such as Nepal is common due to the geographical terrain and lifestyle associated with farming. Moreover, the required immediate treatment is mostly centralised in urban areas, hence the mortality of rural patients. Along with it concurrent association of neurotoxicity and nephrotoxicity due to russel viber snake bite are rarely encountered but manageable if intervened on time. Through this case, we tried to bring into global view how in lower middle-income countries healthcare access for even small cases such as snakebite are hard to get by.

Ethical approval

Ethical approval is exempted in case of case reports in our Institution. Whereas written informed consent has been taken from the patients himself.

Consent

Written informed consent has been taken from the patient himself and can be made available if asked by the chief editor.

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Author contribution

S.G.: study concept, case presentation formulation, manuscript writing and review. B.D.S., A.A.M.: patient diagnosis and management, study concept, manuscript review. S.., B.K.: manuscript review, discussion writing. T.U.: introduction writing , manuscript review.

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