CASE REPORT OPEN ACCESS

Respiratory Failure Following a Venomous Snakebite: Importance of Ambu Bag Ventilation in a Poor-Resource Setting

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ABSTRACT

Venomous snakebites are critical medical emergency. Most fatalities resulted from respiratory failure attributable to abrupt neuromuscular paralysis. A 35-year-old male was treated for a snakebite on the dorsum of his right foot, which occurred seven hours prior to hospital admission during sleep. The patient exhibited symptoms of headache, myalgia, extremity weakness, and altered consciousness. No hemorrhagic or myotoxic symptoms were observed. He subsequently had respiratory failure, necessitating emergency bedside intubation with an Ambu bag, followed by treatment initiated in the district hospital and continued in the intensive care unit of a medical college hospital. Timely diagnosis, immediate transport to a medical facility, and rapid bedside intubation can save the lives of individuals experiencing respiratory failure due to venomous snake bites. **JEL Classification:** General Medicine

1 | Introduction

Snakebite is one of the most common injuries caused by toxins in Bangladesh, which is responsible for a large share of causality, particularly in remote parts of the country. A recent community-based survey in Bangladesh found the incidence of snakebite is around 623.4/100,000 person-years, with 6041 deaths noted per year, a significant increase from the previous estimation [1]. There are five snake groups in our country that have critical healthcare importance, the *Cobra*, *Krait*, *Green pit viper*, *Russell's viper* and *Sea snakes*. The *Cobras* and *Kraits* are the primary venomous animals in our nation. The bulk of poisonous bites are caused by *Kraits*, accounting for 77.78% of cases, followed by cobras at 22.23% [2]. Neurotoxicity is the primary characteristic of these venomous snakes, with respiratory failure being the primary cause of mortality after envenomation [1]. *Kraits* typically engage in nocturnal biting behavior upon entering residences in pursuit of sustenance [3]. Most of the bites took place during the night while the victims were sleeping on the floor [4]. Historically, traditional healers, known as Ojhas, have addressed snakebite cases employing non-scientific approaches that frequently result in adverse consequences for the affected individuals [1].

The envenoming caused by these snakes is a critical medical situation that poses a severe risk to life. It necessitates using specific antivenoms and other interventions, including immediate assisted ventilation in cases of respiratory paralysis [5]. Hence, endotracheal intubation and artificial breathing facilities are essential for thoroughly treating neurotoxic snake bites [6].

In the rural areas of our developing country, the absence of quick access to lifesaving anti-snake venom serum (ASVS)

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Summary

- A 35-year-old man who was treated for an unidentified snakebite experienced respiratory failure.
- Immediate intubation followed by ventilation maintained by Ambu bag was arranged at the bedside, and mechanical ventilation was done hours later because of lack of resources.
- Early diagnosis and immediate bedside care with basic equipment can save lives.

and mechanical ventilation for respiratory support leads to increased case fatality rates [7].

2 | Case History/Examination

A 35-year-old male bakery worker, hailing from Thakurgaon, Bangladesh, came to the Emergency Department of the General Hospital, Nilphamari, on October 9, 2023 at 9:30 a.m., complaining of a bite by an unidentified snake to his right foot near the little toe at 3.00 a.m. on October 9, while he was sleeping in a tin shed house nearly 07h before from the time of examination. At that time, he woke up from sleep and saw that there was bleeding from the bite site, but he did not see anything in the room. After about half an hour of biting, he develops pain in the bitten site, severe headache, and body aches. He was treated by a local traditional healer (Ojha) with scratching of the bitten site. As there was no improvement with this treatment, he ligated the right leg with rope in three areas and visited Thakurgaon District Hospital. In the Emergency department of Thakurgaon District Hospital, ligature by rope was removed and two firm tourniquets were given with roller bandages. After that, he was referred to Nilphamari District Hospital because of a lack of antivenom.

On examination, the patient was altered conscious; pulse 88/ min, regular, blood pressure 120/80 mmHg, respiratory rate 25breath/min, oxygen saturation 98% in room air, bilateral partial ptosis, broken neck sign was present, pupils are normal reacting to light, and the chest was clear on auscultation. The local examination of his right foot showed no swelling, bruise, redness, hotness, or tenderness except for bite marks (Figure 1), and at that time, the snakebite severity score was Grade 3 [8].

3 | Methods (Differential Diagnosis, Investigations and Treatment)

After clinical examination, blood samples were taken for a bedside 20min whole blood clot test, which was negative. While preparing for specific management, the patient's breathlessness increased, and consciousness reduced within the next half hour. Oxygen saturation suddenly fell to 40%, and severe bradycardia (heart rate < 40 b/min) developed; then, at that time, the snakebite severity score was grade 9. The patient was intubated at the bedside with the help of an anesthesiologist, and ventilation was maintained with an Ambu bag (Figure 2). The first dose of the polyvalent snake antivenom containing 10 vials was given by intravenous infusion with ready of the bedside anti-anaphylactic measures. Injectable subcutaneous neostigmine 2.5 mg, along with intravenous atropine 1.2 mg, was given for neurotoxic features. As there was no satisfactory improvement after first dose, we gave the second dose of antivenom containing another 10 vials after 1 h of first dose. Followed by the patient was referred to Rangpur Medical College Hospital for ICU support with maintaining ventilation by Ambu bag, which was 55 km away from Nilphamari.

Investigation reveals complete blood count—hemoglobin 13.6g/dL, erythrocyte sedimentation rate 12 mm in first hour, total white blood cell count 8.6×10^9 /L, neutrophil 66%, and platelet count 261×10^9 /L. Liver function tests showed serum alanine aminotransferase was 24 IU/L, serum aspartate aminotransferase was 45 IU/L, prothrombin time was 15 s, activated partial thromboplastin time was 26 s, serum creatinine was 1.00 mg/dL, serum cardiac troponin I was <0.01 ng/mL, and random blood glucose was 122 mg/dL. Urine analysis showed normal physical, biochemical, and microscopic examination; its amount was 2300 mL/day. The third dose of polyvalent snake antivenom containing another 10 vials were administered intravenously with ready of the bedside antianaphylactic measures on the same day. The patient was maintaining mechanical ventilation for the next 72 h.



FIGURE 1 | Affected leg site.



FIGURE 2 | Intubation and ventilation by Ambu bag.

4 | Conclusion and Results (Outcome and Follow-Up)

On the third day, October 11, 2023, the patient regained his full consciousness, pulse was 80/min, regular, blood pressure 120/80 mmHg, and extubation was done successfully. After extubation, oxygen saturation was 97% with 10 L of O_2 , then gradually reduced O_2 inhalation to 2 L over the next 48 h, then maintained 91%–94% without O_2 . He was shifted to the medicine ward from the ICU on October 12 with stable vital signs. The patient remained fully conscious with stable vital signs in the ward for 4 days. He was discharged on October 17 with hemodynamically stable physical signs.

5 | Discussion

Snakebite continues to be an undervalued factor contributing to unintentional fatalities in Bangladesh. The annual mortality rate from snake bites in rural Bangladesh is 6041 [2]. Numerous misconceptions and fallacies surrounding snake bites contribute to postponing the affected individuals' admission to the emergency department. Neurotoxic snake bites are strongly linked to a high mortality rate caused by rapid respiratory failure, particularly in rural regions [9]. For early identification and prompt recognition of the patient's clinical severity, snake bite severity score can be applied to start a prompt treatment. For example, our patient severity score jumped from 3 to 9, guiding us to take drastic measures [8].

Neurotoxins found in snake venom that attach to acetylcholine receptor sites on the motor endplate cause symptoms that are comparable to those of myasthenia, which can rapidly escalate and worsen [3]. The neurotoxic snake bite case resulted in the occurrence of type II (hypercapnic) respiratory failure. The occurrence of severe neuromuscular paralysis and poor ventilation was attributed to the impact of the snake's toxin, which targeted the neuromuscular junction [10, 11].

In our patient, as there was no definite proof of which category of snake bite the patient, assuming that from severe neurotoxin features with myasthenia-like syndrome associated with respiratory failure, *Krait* could be one of the strongest of suspicions [12].

A patient with a snake bite necessitates immediate emergency care, starting from local immobilization by applying a pressure bandage with cloth pieces, taking the patient to the hospital quickly with any motorized vehicle, administering antivenom, and appropriate respiratory support with mechanical ventilation [1]. These interventions have the potential to enhance the patient's prognosis and reduce fatality rates [13]. This patient came to our hospital with severe neurotoxic features and impending respiratory failure. We managed the patient with supportive measures, antivenom, and bedside ventilation maintained by Ambu bag. Then, we transferred the patient to the ICU with an Ambu bag, which was 55 km away from our hospital. Following 4 days of receiving mechanical ventilation in the ICU and an additional 5 days of medical treatment in the general ward, the patient successfully recovered and was discharged.

The timely identification, prompt delivery to medical facilities, and effective therapy of neurotoxic snake bites are crucial factors in attaining favorable outcomes. The recommended treatment protocols for venomous snake bite patients include antivenom and anti-acetylcholine esterase (causative therapy), prophylactic infections of the bitten limb (additional therapy), and ventilator support (supporting therapy). These interventions are essential in preventing respiratory failure and saving the patient's life [14]. Implementing ventilatory care can be straightforward, has proven to be lifesaving, and is usually short and uncomplicated, as the lungs have normal mechanics [15, 16]. Critical care in low-resource settings has been a challenge in rural or semi urban areas of Bangladesh. Use of equipments like Ambu bag not only prevent immediate collapse of the patient but also improve the long term disability from prolonged hypoxic condition [17].

In the case of a venomous snake bite where severe neurotoxic features, including respiratory muscle paralysis, occurred, immediate initiation of mechanical ventilation, even at the bedside for respiratory support along with other management can save many lives.

Author Contributions

Abdul Matin: conceptualization, writing – original draft. Sarwar Alam Sobuj: investigation, supervision. Prity Saha: supervision. Chowdhury Adnan Sami: writing – review and editing.

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Ethics Statement

The authors can confirm that informed written consent was taken from the patient for publication.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The authors have nothing to report.

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