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Neurotoxic snakebites at a primary healthcare center in Nepal: an experience of a PAHS graduate

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Abstract

Nepal has one of the highest snakebite fatalities in South Asia. Most bites occur in rural areas where there is a lack of both adequate facilities for treatment and transport. Despite several limitations, prompt access and focus on supportive care are the major strengths of peripheral healthcare centers. Here we present the management of two cases of neurotoxic snakebites. Timely intervention can save lives in case of snakebites; hence establishment of snakebite treatment centers in the periphery can mitigate the problem of delay in care. Patan Academy of Health Sciences can contribute by training medical graduates in snakebite management.

Keywords: anti-snake venom serum, envenomation, primary care, snakebite

Introduction

Patan Academy of Health Sciences (PAHS) aims to improve rural health by training competent, caring, and socially responsible physicians. Every year, PAHS sends out 40% of graduates to serve the rural community, including lowlands terai in southern Nepal, where snakebite is a major problem.[1]

Here we share the experience of a PAHS graduate posted at Beltar Primary Healthcare Center (Beltar PHC) in Udayapur District of Nepal. Snakebite is among the five topmost prioritized hazards in Udayapur.[2]

Following the transition to local governance, a snakebite treatment center was established at the PHC in coordination with Nepal Army. Within two years of establishment, a total of 223 cases of bites were received which included envenomation, suspected bites, and insect bites, minimizing the need to transfer these patients to higher healthcare centers.

We present two cases of neurotoxic snakebites with different presentations, progression, and complications managed at a local PHC with limited facilities.

Case Reports

A 9-Year-old with cobra bite

A 9-year-old male was brought by his mother with the chief complaint of severe pain following an unknown bite on the right leg while leaning against a wall in broad daylight. He lived nearby to our health center and presented within 15 minutes of the bite. On arrival, his oxygen saturation was 99% in room air, pulse was 104/minute, and he was afebrile. Fang mark with minimal fresh bleeding and swelling was present at the site of the bite which later developed ecchymosis, Figure 1. Development of ptosis and slurring of speech was difficult to observe on presentation as the child was crying the whole time, leading to puffy eyes, Figure 2. There was no visible bleeding from other sites. Cardiopulmonary and central nervous system examination were unremarkable. Intravenous access (IV) was secured, the affected limb was immobilized and the child was kept under close observation.

Figure 1. Case-1, bite site in a 9-year child showing fang mark with minimal bleeding

After 30 minutes of arrival, the patient first developed ptosis followed by slurring of speech, difficulty in protruding the tongue and shortness of breath. His saturation dropped to 85% in room air. Oxygen was administered at 4 l/minute via nasal prongs and another IV access was secured. He received prophylactic subcutaneous adrenaline (1:1000) 0.12 ml stat. Ten vials of Anti Snake Venom Serum (ASVS) diluted in 220 ml of normal saline was infused over 1-hour. He also received intravenous atropine 0.3 mg stat, intramuscular neostigmine 0.6 mg stat, intravenous hydrocortisone 50 mg every 12 hours, and intramuscular tetanus toxoid 0.5 ml stat. Intravenous ondansetron 2 mg stat was administered as the patient complained of nausea. He also received intravenous ceftriaxone 500 mg every 12 hours and intravenous ranitidine 25 mg every 12 hours.

He was continuously monitored for signs of anaphylaxis. During the ASVS infusion, he developed profuse sweating and salivary secretions. He continued to maintain consciousness and obey instructions. He was able to spit out the secretions so suctioning was not necessary. Per rectal paracetamol, 250 mg was given as the patient complained of pain at the bite site and body ache. Within an hour of starting ASVS, he gradually showed improvements - he was able to protrude his tongue, ptosis improved, and was weaned off the oxygen. A maintenance dose of 2 vials of

ASVS diluted in 500 ml of 5% dextrose was administered over 8 hours. He was catheterized and 300 ml of urine was collected which was normal in color. Two hours post-administration of ASVS, he showed no signs of neurotoxicity. An emergency laboratory facility was not available in the PHC. Lab reports obtained on the next day revealed hemoglobin 11 mg/dl, creatinine 0.7 mg/dl, and normal urine analysis. He was discharged from PHC on day-2. The case was recorded as a presumed cobra bite in view of his symptoms, their progress, and prompt recovery. He was kept under alternate day follow-up for wound care. On his 4th follow-up, the wound was gradually increasing in depth with areas of necrosis and hyperemia. The need for debridement was suspected and he was referred to a higher center for surgical consultation.

Figure 2. Ptosis in case-1 (note the image is overlapped deliberately to minimize revealing the identity)
Figure 3. Inability to protrude tongue and ptosis in case-2

A 17-year-old with krait bite

A 17-year-old male presented with the chief complaint of being bitten by a snake on his left thumb while collecting fodder in the forest. Within 30 minutes of the bite, he was brought to our center by his father on a motorbike from Basaha, a village 7.4 km away. He saw the snake but was unable to describe its identifying characteristics. On arrival, he looked comfortable and was maintaining oxygen saturation, pulse was 110/min, respiratory rate was 14/min and blood pressure was 100/70 mmHg. A tourniquet had been applied at home, at base of the thumb. Fang marks were barely visible and there was no bleeding, ecchymosis, swelling, or pain at the site of the bite. Cardiopulmonary, gastrointestinal, and central nervous system examination were within normal limits. Intravenous access was secured, the affected limb was immobilized and the patient was kept under close monitoring with neurological examination done every 15 minutes.

Repeated physical examinations did not yield any new findings during the first 3 hours of observation. The first symptoms the patient developed were blurring of vision and ptosis, Figure 3. After that, the decision to start ASVS was made and prophylactic subcutaneous adrenaline (1:1000) 0.25 ml stat was administered. He was given 10 vials of ASVS diluted in 400 ml of normal saline over 1 hour. He also received intravenous atropine 0.6 mg stat, intramuscular neostigmine 1.5 mg every 30 mins, intravenous ondansetron 4 mg stat, intramuscular tetanus toxoid 1 ml stat, and intravenous hydrocortisone 200 mg 12 hourly. Ceftriaxone 1 g IV and ranitidine 50 mg IV were given every 12 hours. He was catheterized and urine output was normal.

Continuous examination revealed deterioration of his neurological status. He developed tachypnea, slurring of speech, inability to protrude tongue, and difficulty swallowing during 2 hours observation. Following progressive symptoms, additional dose of 5 vials ASVS diluted in 500 ml was given over another 1 hour. Intramuscular neostigmine was discontinued following no improvement in neurological symptoms.

He did not develop signs of anaphylaxis during the ASVS infusion. Profuse sweating and salivary secretions were managed with suctioning and glycopyrrolate 0.5 mg. He remained conscious throughout.

Improvement in symptoms did not start until 2 hours after the administration of the second dose of ASVS. The blurring of vision was the first symptom to improve. His vitals stabilized and he gradually improved. His laboratory findings done on the second day were within normal limits. He was discharged on 3rd day of hospital admission and was called for follow-up. Mild ptosis persisted up until 3rd day after discharge. The case was recorded as a presumed krait bite in view of his late onset of symptoms, absence of features of local envenoming, and delayed recovery.

Discussion

Snakebite accounts for significant morbidity and mortality worldwide. Nepal has one of the highest snakebite fatality rates in South Asia.[3] In Nepal, over 20,000 people are bitten by snakes each year and over 1000 die from envenomation as estimated by the World Health Organization.[4] Most cases of snakebites are reported during summer and monsoon season, mostly from terai region of the country.[1] Factors that increase snakebite incidence are plain terrain, long summer period with an average temperature of 36-37^{0}C, long monsoon, and an agriculture-dependent population. Disproportionately affecting poorer populations in rural areas seems to be a norm for snakebite worldwide.[5]

At least 70 snake species are known to exist in Nepal.[6,7] Most of the envenoming and deaths are caused by seven species: kraits (Bungarus caeruleus, B. walli, B. lividus, and B. niger), cobras (Naja naja and N. kaouthia) and viper (Daboia russelii).[6,7] The clinical picture depends on the species, age of the snake, location, duration of the bite, and geographical location.[8]

Management of snakebite is often focused on identifying species of snake, determination of toxicity, clinical stabilization, and use of appropriate antivenom.[8,9] Envenomation by different families of venomous snakes often produces overlapping and nonspecific clinical symptoms which are frequently difficult to differentiate from anxiety due to the bite.[8,9]

Nepal recently came up with its first protocol on snakebite management in 2019.[10] The protocol divides venomous species found in Nepal into two groups 1) family Elapidae which consists of krait and cobra and 2) family Viperidae which includes vipers. The guideline proposes a syndromic approach to snakebite envenoming. The presenting symptoms are divided into 5 syndromes. The neurotoxic envenomation fall into Syndrome 1, 2, and 3. Neurotoxic presentations with local swelling are classified as syndrome 1 and are likely due to cobra bite while neurotoxic presentation with minimal local sign, abdominal pain, and nocturnal bites while sleeping on the ground is thought to be due to krait. If a neurotoxic presentation includes dark brown urine and muscle pain, it is classified as syndrome 3 and suggests B. niger krait bite.

The onset of symptoms and complications happen promptly in cobra bite, sometimes as early as 30 minutes. Recovery after an appropriate treatment also follows a quick path because of the reversibility of the postsynaptic neurotoxicity of cobra venom. Krait bites, on the other hand, develop symptoms slowly and the rate at which recovery occurs is also slow. This slow nature of recovery is attributed to the fact that neurotoxins found in krait venom act at

presynaptic nerve terminal, repair of which is a time extensive process.[10]

Snakebite is a time-sensitive issue. Rapid transportation of patients to nearby snakebite centers can be vital in determining management outcomes. An interventional study found a strong association between the use of a motorcycle, the quickest means of transport on the simple trails linking most villages in rural Nepal, with the survival of snakebite victim.[11]

A complete blood count with platelet count, coagulation profile, measurement of fibrin degradation products, electrolytes, blood urea nitrogen, and serum creatinine, and urinalysis are recommended base-line laboratory studies. It is also recommended to repeat these after each infusion of antivenom.[1] Beltar PHC probably represents many rural healthcare settings in Nepal and other developing countries, without the facilities to conduct many of these tests. Trained health personnel in the management of snake bites, availability of ASVS and emergency supplies are simple yet necessary lifesaving measures in such rural setups.

Like most rural areas, there is an obvious shortage of anti-venoms in our setting. That means in terms of management while recognizing that antivenom is the mainstay of treatment, the importance of supportive therapy increases. Our patients were lucky in that we had a team of army trained in snakebites. We also happened to have an adequate supply of antivenom then, which is not a usual case.

Despite the inadequacies, there are certain strengths of a PHC setting which makes it a crucial place for snakebite treatment. One of the major advantages of a rural PHC is its accessible location which can provide prompt supportive treatment in snakebite which is a very time-sensitive issue. Functioning as a bridge to higher centers, PHCs can aid in the management of complicated snakebite cases.

The provision of manpower trained in the management of snakebite can help patients like that of ours. Most PHCs are looked after by medical officers. One way to ensure they have adequate knowledge and training in snakebite management is to expand the topic during the undergraduate medical school curriculum. At PAHS, snakebite is included as a clinical presentation under the topic Bites and Sting during Junior Clinical Rotation in Internal Medicine. However, this clinical presentation usually takes the form of a common lecture. While this touches on the topic of snakebite, it does not adequately prepare the graduates to deal with a case. Combined with the fact that we generally do not see cases of snakebites at Patan Hospital, the graduates do not get the first-hand experience in managing snakebite cases. Graduates of PAHS get posted in many snakebite prevalent settings. Hence, preparing them beforehand in the management of snakebite via curriculum modification, field visits to snakebite envenomation treatment centers, and training before placement can be beneficial. Institutional collaboration with the Epidemiology and Disease Control Division of Nepal for training the graduates can be a step towards universalization of management protocol in Nepal.

A holistic approach to snakebite management include patient education, health personnel training (especially those going to rural regions in tropical countries), availability of life-saving measures at the treating center, emphasis on enlisting locally present snakes, maintaining a standard of care and quality and availability of antivenom. Use of tourniquet in snakebite is not recommended.[10] However, our case-2 presented with a tourniquet in place, a common first aid used by villagers.[12] This demonstrates a need for community education in snakebite prone areas.

Conclusion

Timely intervention and use of Anti Snake Venom Serum was successful in saving the lives of two case of snakebites at a primary health center in the peripheral terai region. Appropriate training of medical graduates before they are posted to snakebite prone areas and availability of basic facilities are essential to save life.

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Conflict of Interest

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Author Contribution

Case management, draft preparation- CS; literature review and manuscript writing- SA. All authors have read and approved the final manuscript.

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