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A review on snake bite and its managements

Mukesh Kumar Chaudhary
Crimson College of Technology, Butwal-11, Rupandehi, Nepal.
*mkc9847047000@gmail.com

ABSTRACT

Venomous snakebite is a major health problem in Nepal. According to WHO, annual morbidity due to snake bite is 162/100,000 peoples in Nepal. Each year in Nepal there is around 1000 deaths in hospital from an estimated 20,000 snake bites. In Nepal, most common poisonous snakes are cobra, viper, pit vipers and coral snake. The most common symptoms of poisonous snake bites were pain, ptosis, respiratory distress, vomiting, dysphagia, dysphonia, blurred vision, etc. First aid involves reassurance, immobilization of whole body, use of tourniquet on bitten limb with correct techniques and avoidance of use of traditional techniques. Patients should be rushed to the hospital as soon as possible, because delay in the treatment increase mortality and morbidity. Specific antivenom is given if there is sing and symptoms of systemic or local envenoming. Other supportive drugs should be used according to the needs and situations. Health care providers need better training and national treatment guidelines should be developed fed by evidence based data and clinical trials.

Key words: *Ant-snake venom, epidemiology, envenoming, poisonous snake, venom.*

INTRODUCTION

Snake bite is a most common life threatening medical emergency and a high incidence of snake bite is reported from rural area. But due to inadequate epidemiological data the incidence is underestimated [1]. When an individual is bitten by a poisonous snake, venom is injected, causing localized symptoms of mild pain and edema and generalized ones including dyspnea, ptosis, mental alteration, and tachycardia. In severe cases, patients develop acute renal failure, myocardial infarction, disseminated intravascular coagulation, and even death [2]. Treatment for poisonous snakebite is divided into supportive care and antivenom administration[3]. Culture of fangs, fang sheaths, and venom of various snakes have shown heavy colonization with many bacteria and anaerobes so antibiotics were also used in treatment [4]. Time delay between the snake bite envenomation and initiation of treatment with ASV (Ant-snake venom) has a great bearing on mortality rate. If the ASV treatment is initiated within 12 hrs the mortality rate may be 2.6% and if it is more than 24 hrs the mortality rate will be around 13.5% [5]. The incidence of snakebite is high in warmer regions where snakes are found abundantly and agriculture is the main economic source. The highest incidence of snakebite poisoning was seen during the months of June, July and August which corresponds to the monsoon season in Nepal [3].

Since prehistoric times, snakes have been worshipped, feared, or hated. Regrettably, snakes remain a hurting reality in the daily life of millions of villagers [6]. Nepal has huge agriculturally productive terai region with the hot climate and soaring seasonal rainfall. It also has high density of rodents, reptiles and amphibians which makes it an ideal habitat for snake to live and hibernate [7]. Snake bite has high fatality due to various factors. There is a lack of public awareness, education, wide spread myths and superstition regarding snake bite which restricts patient in seeking proper treatment in anti-snake venom treatment center [8]. In Nepal, the commonest poisonous snakes in the terai and inner-terai regions are Cobras and Kraits [9]. According to World Health Organization (WHO), more than 20,000 cases of snake bites and 1,000 deaths may occur annually. A community based study in south eastern Nepal showed an annual incidence of 1162 bites/100000, annual mortality rate of 162/100000 and case fatality rate of 27% [3,10].

Anti-venom first developed by Calmette (1895) aimed to neutralize venom toxins and was experimented against Indian Cobra [6]. There are two types of anti venom i.e monovalent antivenom and polyvalent antivenom [9]. Those who developed signs of envenomation with evidence of neurotoxicity like ptosis, external ophthalmoplegia, respiratory paralysis and other signs of hemotoxic poisoning were managed with ASV according to the WHO guidelines 2010 [3]. Composition of anti snake venom available is Nepal is polyvalent [5]. Increasing amount of administrated antivenom usually increases the risk of serum sickness [11]. Pyrogenic, anaphylactic and anaphylactoid reactions may result due ASV administration and possibly result in death [12]. The aims of this review is to discussing and summarizing the epidemiology, types of snake, clinical features, laboratory findings and treatment of poisonous snake bite giving emphasis on perspective of Nepal.

METHODS

Articles were searched and identified by Medline through PubMed using various combinations of terms including "snake," "poisonous snake bite," "envenoming," "venom" and "anti-venom." Research papers and case reports from SARC countries were retrieved and other significant papers from other countries. Additional articles were obtained by citation tracking of review and original articles. The review also represent on conference proceedings and original research conducted by the different researchers.

EPIDEMIOLOGY

Precise size of problem and death from snake bite is very difficult to estimate due to lack of proper data in Nepal. Hospital records are only sources of information for most snake bite reported in Nepal. In a survey conducted between 1980 and 1985 by the ministry of health 3189 cases of snake bite with 144 deaths were recorded from 15 districts. Over all death rates among all the cases of snake bite was 4.5% in community based survey conducted in south east Nepal [7]. Snake bites are more common in young men and women. The bites victims are mostly

from terai region and they are mostly from rural areas [13].

DISTRIBUTION OF VENOMOUS SNAKE

Snakes are distributed all over the world except in Arctic, New Zealand and Ireland [11]. In Nepal, the most commonly found poisonous snakes include 4 species of krait, 3 species of cobra, 9 species of viper, 1 species each of coral snake, Himalayan pit viper, mountain pit viper and Russell's viper. The commonest poisonous snakes in the terai and inner-terai regions of Nepal are Cobras and Kraits [9].

SNAKE VENOM

Snakebites are ecological and occupational hazards, predominantly of rural areas [14]. Snake venom is mixture of enzymatic and nonenzymatic compound, nontoxic proteins including carbohydrates & metals [15]. There are about 20 toxic enzymes which form the deadly weapons of snakes. The venom contains phosphodiesterase, cholinesterase, hyaluronidase, ATPases and various toxins and other enzymes a major components, as well as small peptides, amino acid, carbohydrates, lipids, nucleosides, biological amines, metal ions and proteases [6]. Cobra venom contains neurotoxins and cardio toxin. Viper contains acetylcholinestrase and vasculotoxins disturbing coagulation pathways. Krait venom contains neurotoxin which results in presynaptic blockage [15].

SNAKE ANTIVENOMS

Anti-venom is a biological product usedin the treatment of venomous bites. It is a purified fraction of immunoglobulin orimmunoglobulin fragments fractionated from the plasma of animals that have been immunizedagainst venom. Antivenom should be stored atbetween 2 and 8°C [6,16].

ANTI-VENOM TYPES

Monovalent antivenoms

Monovalent antivenins are limited in use to a single species of venomous snake or to a few closely related species whose venoms show clinically effective cross-neutralization. However, most countries are inhabited by several medically important species of snakes, where there may be no distinctive clinical syndrome to direct the use of a monospecific antivenom. In these cases, the manufacture of polyvalent antivenoms should be highly recommended [17].

Polyvalent antivenoms

Polyvalent antivenoms are preferred in many countries because of problems with specific diagnosis [14]. Polyvalent antivenoms can be generated by immunizing animals with a mixture of venoms from various snake species. The resulting antivenom will then contain antibodies against venom components of various snake species [17].

SIGN AND SYMPTOMS OF SNAKE BITE

Some people who are bitten by snakes or suspect or imagine that they have been bitten, may develop quite striking symptoms and signs even when no venom has been injected. This results from an understandable fear of the consequences of a real venomous bite. Anxious people may over-breathe so that they develop pins and needles of the extremities, stiffness or tetany of their hands and feet and dizziness [14]. Others may develop vasovagal shock after the bite or suspected bite-faintness and collapse with profound slowing of the heart. Others may become highly agitated and irrational and may develop a wide range of misleading symptoms. Blood pressure and pulse rate may increase and there may be sweating and trembling [18]. In number of snake bites only local effects occur because insufficient venom is injected or the snake is non-venomous. With significant envenoming there may be local or systemic effects. These range from non-specific effects to major organ effects [19]. A common faith is that snake bites inevitably result in envenoming. However, bites by nonvenomous snakes are common and bites by venomous species are not always accompanied by the injection of venom (dry bites). A large survey conducted in ten hospitals of southern Nepal found that envenoming occurred in only 10% of the victims [20]. In Bangladesh the percentage of nonenvenoming bites reported in hospital based studies rages between 60% to 80% [21,22]. Similarly in India one study found that only 34% of patients with snake bite develop signs of systemic envenoming [23].

DIAGNOSIS

The identification of snake species is essential for best possible clinical management, because it permits health care providers to choose the suitable treatment, predict complications and therefore to improve diagnosis. In number of cases the biting snake is not seen and if it is, its description by the victim is often misleading [24]. Even when the dead snake is brought to the hospital, misidentification is frequent. For example, hump-nosed pit vipers are frequently misidentified as saw-scale vipers in India [25]. Most health care providers in South Asia have to rely on the circumstances of the bite and clinical features of envenoming to assume the biting species. Coagulopathy, is diagnostic for viper and pit viper bites in South Asia and can be observed using the 20 minute whole blood clotting test [26].

Immunoassays for detection of venom antigens in the body fluids have been illustrated for a number of species and attempts have been made to develop ELISA tests for South Asia. PCR amplification and sequencing of snake DNA obtained from bite-site swabs has recently been used to identify biting snakes in an animal models and in clinical cases from Bangladesh and Nepal. The usefulness of this method as a diagnostic tool, however, awaits further study [27].

MANAGEMENT OF SNAKE BITE

A survey conducted in India and Pakistan showed that many health care providers were not able to recognize signs of envenoming [28]. Improving the knowledge of health care-givers at all levels of the health system is a challenge of paramount importance and great urgency in South Asia. Papua New Guinea, where snake bite management training programmes have been implemented in both rural and urban hospitals, could serve as an inspiring model in this regard [27].

First aid

The most essential aspect of prehospital care of a person bitten by poisonous snake is rapid delivery to a medical facility equipped to provide supportive care and antivenom administration. The patient should be free from anxiety and the whole patient should be immobilized and especially the limb, using a splint or sling. Most conventional first aid methods are potentially unsafe and should not be used. Tight tourniquets are potentially dangerous as they can cause gangrene and peripheral nerve palsies [29]. The most of the professionals agree that snake bite victims should be transported as quickly as possible to a health care centre where they can be examined and evaluated by expert health care providers and where antivenoms are available. In fact, time to reach health care centre was shown to be a crucial determinant of snake bite mortality in eastern Nepal [30]. Some study confirmed that delayed antivenom administration was associated with an increased risk of complications [31].

In case of bites by Krait, pressure immobilization of the bitten limb with properly applied bandage to compress superficial veins and lymphatics has been found to prevent spread of venom and delay onset of respiratory paralysis. Attempt should be made to identify the snake, without endangering the patient or rescuer [32].

Patients being transported to the health care centre should lie on their left side in the recovery position to avoid aspiration of vomit. Persistent vomiting can be managed with anti-emetic drugs. Syncope, shock, angio-oedema and other autonomic symptoms can be managed with epinephrine and antihistamines. Respiratory distress and cyanosis should be managed by airway clearing, providing oxygen and if necessary assisted ventilation. If the patient is unconscious and no femoral or carotid pulses can be detected, cardiopulmonary resusction must be started immediately [33].

HOSPITAL MANAGEMENT

Patients must be admitted to the hospital for observation bitten by any species of snakes. In hospital patients vital signs, cardiac rhythm, oxygen saturation and urine output should be closely monitored and history is obtained quickly and rapid. If needed patient airway, breathing, and circulation should be stabilized. In case of hemodynamic instability, fluid replacement with normal saline should be initiated. The sign and symptoms of local or systemic envenoming should be determined. If indicated antivenom therapy should be started. Any tourniquet or constriction band if applied as first aid should be removed once IV access has been obtained and resuscitation and antivenom facilities

are available. During the duration of observation the extremity should be positioned at approximately to heart level. Patients of neurotoxic envenomation should be watched carefully for evidence of cranial nerve dysfunction (e.g., ptosis) that may precede the onset of difficulty in swallowing or respiratory depression and necessitate securing of the airway by endothelial intubation and assisted ventilation may be needed. A number of patients do not result in envenomation; thus patients without the features of local or systemic envenomation should be discharged from medical attention after 24 hour observation [32,34,35].

Antivenom

The only specific therapy for snake bite envenoming is immunotherapy. The antivenoms are obtained by fractionation of plasma produced from immunized horses [36].

Monovalent antivenom

Monovalent antivenoms are limited in use to a single species of venomous snake or to a few closely related species of snakes whose venoms show clinically effective cross-neutralization. These antivenoms are used in areas where there is only one medically important species of snake is found [37].

Polyvalent antivenoms

Polyvalent antivenom can be produced by immunizing horse with a mixture of venoms from various species of snakes. The resulting antivenom will then contain antibodies against venom components of various species of snake [37].

Selection and dose of antivenom

Monovalent antivenom is suitable if the biting species is known. Polyvalent antivenoms are used if difficulties arise in the identification of the biting snake species. It is almost never too late to give antivenom while signs of systemic envenoming persist, but ideally, it should be given as soon as it is indicated. There are two methods of administration of reconstituted freeze dried antivenom:

a. By slow IV infusion (not more than 2ml/minute)

b. IV infusion mixed with 5-10 ml of normal saline or 5% dextrose.

In Nepal some dose of antivenom is given as IV bolus and some as IV infusion in isotonic fluid [32].

If patient develops acute reactions to antivenom, the infusion must be temporarely stopped and the reaction immediately treated with IM epinephrine and IV antihistamines and glucocorticoids. Once the reaction is controlled, if the severity of envenomation warrants additional antivenom, the dose should be diluted further in normal saline and restated as soon as possible. Rarely, in refractory case, a concomitant IV infusion of epinephrine used to manage allergic reactions while further antivenom is administered [32,38].

Management of antivenom reactions

Epinephrine is used for management of early reactions; 0.5 to 1ml of 0.1% is given by intramuscular injection to adults at the first sign of reaction. Then the dose may be repeated if the reaction is not controlled. Patients with profound hypotension, severe bronchospasm or laryngeal edema may be managed with epinephrine by slow IV infusion. Pyrogenic manifestations are managed by using antipyretics. Late reactions should be treated with glucocorticoids until all finding resolves [39].

Ancillary treatments

The management of poisonous snake bites is not limited to use of antivenoms. In the case of neurotoxic envenoming artificial ventilation and careful airway management are essential to avoid asphyxiation in patients with respiratory paralysis [40].

Anticholinesterase drugs can partly overcome blockade by postsynaptic neurotoxin and have shown good efficacy in cobra bite envenoming. A few cases of successful anticholinesterase use have also been reported in krait bite envenoming in India [41,42]. Bacterial infections can develop at the bite site, and may require antibiotic treatment [13]. Necrosis of the bitten limb may require surgery and skin grafts, particularly in the case of cobra bites [43].

Prevention of snake bite

Snake bites can be avoided by educating the peoples who are at risk. Sleeping on a cot rather than on the floor and under bed nets decrease the risk of nocturnal bites in Nepal [44]. Garbage,

termite mounds and firewood which can attract snakes should be kept away from the vicinity of human dwellings. Attempts should be made to prevent proliferation and development of rodents in the domestic areas. Thatched roofs and mud and straw walls are favoured hiding places for snakes and should be checked regularly. Using a torch/flashlight while walking at night, and wearing boots and long trousers during outdoor activities could significantly reduce the incidence of bites [45].

CONCLUSION

Snake bite is still one of the commonest life threatening emergencies seen mostly in terai and mid hilly region of Nepal, causing significant morbidity and mortality. Efforts are needed to studies on epidemiology of snake bite and educating the population at risk. Identification of the offending snake is helpful to decide on the type of toxicity and method of treatment to be followed. Rapid access to the hospital equipped with trained medical staffs, adequate antivenoms and facilities for treatment of complications are essential for the survival of the patients with severe envenoming. In many neurotoxic snake bite cases seen in Nepal, besides antivenom therapy, treatments of the respiratory failure and other complications are crucial. There is need to improve in existing health care facility for effective management of snake bite and development of national guidelines based on clinical trials.

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