A Clinico-Epidemiological Profile of Neuroparalytic Snake Bite: Using Low Dose ASV in a Tertiary Care Centre from North India

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Abstract

Objectives: Snake bite in India is a common medical emergency and an occupational hazard for majority of Indian population especially farmers. Epidemiological data on snake bite from the North India is sparse. Hence we conducted this study to find clinico-epidemiological profile of neuroparalytic snake bite.

Methods: This is a record-based, descriptive study carried out at the Department of Medicine, M.L.N. Medical College and associated Swaroop Rani Nehru Hospital, Allahabad, U.P. (India) which is a tertiary care hospital of north India. This study describes the epidemiology, arrival delays and the outcome of neuroparalytic snakebites with low dose ASV along with ventilatory support.

Results: Among the total 113 cases of neuroparalytic snake bite victims (56.63%) were males aged 21-40 years. Majorities of the victims were bitten outdoor (63.71%) and most of the bites occurred on the lower limbs (83%). The highest number of cases occurred during the monsoon season of July-September. Most of the victims were farmers (53.44%) and labourers (30.55%), which suggested that snake bite was an occupational hazard. Mean dose of ASV administered was 16.99 vials. The percentage of patients requiring intensive care and ventilatory support were (40.70%) and the total percentage of patients showing recovery was (84.07%). The most important positive prognostic factor was reaching hospital within 7 hours.

Conclusions: Snake bite can be viewed as an occupational hazard among farmers and labourers. Delay in reaching hospital in time where definite treatment and care can be done was identified as the most important cause of mortality. Low dose ASV administration and ventilatory support can provide sufficient cure if patients reach on time. Public health programs regarding the prevention and the importance of the early arrival to the hospital should be emphasized.

Editorial Viewpoint

• Neurotoxic snake bite continues to be a problem for outdoor working population in monsoon.
• With timely administration of ASV and supportive therapy majority of such patient can be salvaged.
• This study shows low dose ASV can provide sufficient cure.

Introduction

Snake bite is a common medical emergency and an occupational hazard, more so in tropical India, where farming is the major source of livelihood. Every year 50,000 Indians die in 2,50,000 incidents of snake bite, despite the fact that India is neither home for the largest number of venomous snakes in the world, nor there is shortage of anti–snake venom in the country.¹

Over 2,000 species of snakes are known worldwide, of which around 400 are poisonous. These snakes belong to the families Elapidae, Viperidae, Hydrophiidae and Colubridae.² Viper bites are more common than other poisonous snakebites in human beings.³,⁴ Of the different varieties of vipers, the Russel’s viper (Vipera russelli) commonly inhabits the Southern Asian countries and its bite is regarded as an occupational hazard for the farming community. Indian cobra (Naja naja) and Common Indian krait (Bungarus caeruleus) are two important species of elapid snakes found in India and are responsible for most of the cases of neurotoxic snake bite.

Respiratory failure (TYPE II)
is the most important cause of morbidity and mortality in victims of neurotoxic snake bite.⁵ Cobra toxin and α-bungarotoxin act postsynaptically by binding to acetylcholine receptors on the motor end plate while β-bungarotoxin and crototox act presynaptically and prevent release of acetylcholine at the neuromuscular junction.

The main cause of this “unacceptable incidence” of snake bite fatalities is that people try out all kinds of “bizarre remedies” initially, instead of going to the nearest hospital. The available data on the epidemiology of snake bite from the Indian subcontinent is sparse, because most of the snake bites occur in illiterate, rural areas who use witchcraft and traditional healers. Only the cases of snakebite with severe envenomation reach the healthcare centers.

This study was carried out to emphasize the fact that low dose anti snake venom (ASV) along with respiratory support can successfully manage neuroparalytic snake bite.

**Material and Methods**

This record based, retrospective, descriptive study was carried out at the Department of Medicine M.L.N. Medical college and associated Swaroop Rani Nehru Hospital, Allahabad, U.P. (India).

This institute is a referral government hospital in Northern India, where patients come from the districts of Allahabad, Pratapgarh, Jaunpur, Kaushambi and Mirzapur.

The records of the snakebite victims who attended the hospital from June 2012 to December 2014 were obtained from the medical records department. This department uses the ICD-10 system for the classification of diseases.

The data on the demographic factors, clinical features and complications, details of the treatment which was received and the outcome of the snake bite victims were recorded. The statistical analysis was conducted by using the Statistical Package for the Social Sciences, version 11.0 (SPSS Inc, Chicago, IL, USA).

Timely administration of anti-snake venom (ASV) along with cardiorespiratory support is the only effective treatment available for neurotoxic snake bite.⁶ ASV is most effective when administered early enough to neutralize venom in the circulation before it reaches the target site.

But there is still no universal consensus about use of low or high doses of ASV, but the study regarding administration of higher dose (>20 vials) over low dose/conventional dose found that both are equally efficient.⁷

**Inclusion Criteria**

All adult (> 11 years) patients with history of neuroparalytic snake bite.

**Exclusion Criteria**

1. Vasculotoxic snake bites (patients with bleeding diathesis and with deranged bleeding time, clotting time or platelets below 100000 per microliter).
2. Patients with renal failure.

Patients with symptoms of neurotoxic snake bite with or without respiratory failure were admitted to MICU (medicine emergency of our hospital) during the study period. There were 64 males and 49 females aged 11–65 years. Mean duration of time to reach hospital was 4.8 hours. All 113 patients had symptoms of neurotoxicity, ranging from ptosis, dysphagia, respiratory distress, and generalized loss of power to alteration in the level of consciousness. Patients in the respiratory failure were identified by single breath count (SBC). All patients were administered an initial bolus dose of 10 vials of ASV as a continuous infusion over 1 hours followed by observation of vitals and close monitoring. Repeat bolus dose was provided to only those patients in whom respiratory stress did not improved. Atropine and Neostigmine were also administered. Those patients showing respiratory distress, ventilatory support was provided initially by ambu bag through endotracheal tube followed by ventilator support in anesthesiology department which is situated just nearby MICU. Initially, control mode ventilation (CMV) was used; then patients were gradually switched to synchronize intermittent mandatory ventilation (SIMV) with pressure support as neuroparalysis recovered. Meticulous attention was paid to asepsis, nutrition, humidification of inspired air, regular endotracheal toileting and continuous monitoring of hemodynamic and respiratory (including ABG and respiratory mechanics) variables. An effort was made to maintain oxygen fraction in inspired air (FiO2) at <0.5, while maintaining adequate oxygenation (pO2 >60 mm Hg). Weaning was accomplished by gradual reduction in the SIMV rate and the level of pressure support, once adequate respiratory effort had reappeared. A short T-piece trial was given and patients were extubated if they had normal bulbar reflexes and did not show any worsening during the period of T-piece trial.

**Results**

A total of 113 cases of venomous snakebite cases were included in this study, who had reported to the hospital from June 2012 to December 2014. The detailed demographic profile of the snake bite victims have been presented. Most of the cases were males (56.63%) and the male to female ratio was 1.3:1. Majority of the patients were farmers (53.44%) and labourers (30.55%). Most of the victims in our study were bitten outdoors, mostly in the field (n=72, 63.71%) and few indoors (n=41, 36.28%). The peak incidence in the snake bite cases occurred during the monsoon months of July to
snake during their working period. The extreme of age groups are less exposed.

Majority of incidences were in months of June to September i.e. rainy season for northern India in which snakes comes out from their burrows, least cases are seen in the month of October to December which is the period of hibernation for snakes (Figure 2).

As per demographic data, 34 patients came to the hospital within 3 hours of snake bite, with immediate treatment of 10 vials of ASV all survived without any ventilatory support. Fifty-eight patients came to the hospital between 3-7 hours of snake bite, to all these patients 20 vials of ASV was given (initially 10 vials and after no improvement in respiratory effort again 10 vials were given). Out of 58 patients 25 patients required ventilatory support to cure the respiratory failure, as a result all of the patients survived (100% survival rate). 5 patients arrived between 8-10 hours of snake bite, 20 vials of ASV was given along with ventilation support but only 3 patients survived. Sixteen patients out of 113 reached after 10 hours of snake bite, 20 vials of ASV was given along with ventilatory support, but unfortunately none of them survived. As per above data survival rate is maximum when patient comes to the hospital within 7 hours of snake bite (Table 2).

Overall an average 16.99 vials were used to treat all the 113 cases of venomous snakebite to neutralize venom in circulation before it reaches to the target site. Among these 46 (40.70%) patients needed ventilatory support for effective treatment. Need of ventilatory support is inversely related to bite to needle time i.e. bite to arrival at hospital time. Patients who reached within 7 hours show maximum survival.

The average duration of stay in the hospital was 7.5 days with treatment and cardiorespiratory monitoring. Out of 113 patients, 95 (84.07%) patients survived but 18(15.92%) expired (Table 3).

### Discussion

The major families of poisonous
snakes in India are Elapidae, which includes common cobra (Naja naja), king cobra and common krait (B. caerulus), Viperidae includes Russell’s viper, Saw scaled or naja), king cobra and common krait (B. caerulus), Viperidae includes common cobra (Naja snakes in India are Elapidae, which includes common cobra (Naja naja), king cobra and common krait (B. caerulus), Viperidae includes Russell’s viper, Saw scaled or naja), king cobra and common krait (B. caerulus), Viperidae includes common cobra (Naja snakes in India are Elapidae, which includes common cobra (Naja naja), king cobra and common krait (B. caerulus), Viperidae includes Russell’s viper, Saw scaled or naja), king cobra and common krait (B. caerulus), Viperidae includes common cobra (Naja snakes in India are Elapidae, which includes common cobra (Naja naja), king cobra and common krait (B. caerulus), Viperidae includes Russell’s viper, Saw scaled or naja), king cobra and common krait (B. caerulus), Viperidae includes common cobra (Naja

Table 3: End-results in patients

<table>
<thead>
<tr>
<th>No. of ASV vials</th>
<th>16.99 (10–20)</th>
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</thead>
<tbody>
<tr>
<td>Duration of stay in days</td>
<td>7.5 (2–13)</td>
</tr>
<tr>
<td>Ventilatory support needed</td>
<td>46 (40.70%)</td>
</tr>
<tr>
<td>Survived no. of pts (%)</td>
<td>5 (84.07%)</td>
</tr>
<tr>
<td>Expired no. of pts (%)</td>
<td>18 (15.92%)</td>
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were observed in studies in which 84% bites were seen in April to September by Harsoor et al 13 which shows the influence of environmental temperatures and rain with a daytime preponderance. In our study, 83% of bites occurred on lower extremities. Limb bite constituted more than 78%, suggesting that the site of bite was predominantly determined by accidental or inadvertent contact of the snake during the farming activities. Mean time taken for the patients’ arrival in hospital after the bite was 7.75 hours (2.5 hours to 13 hours) in this study, which compares closely with those observed by other workers, Sharma et al (9 hours) and Harssor (7 hours). 11

As per the recommendations of the WHO, the most effective treatment for snake bite is the administration of ASV. The anti-snake venoms are species specific (monovalent/ monospecific) or polyvalent/polyspecific.

In patients signs of neuromuscular paralysis included ptosis, palatal palsy, ophthalmoplegia, pharyngeal palsy and limb and neck muscle weakness progressing to respiratory paralysis. No test dose of ASV was given prior to infusion of ASV as WHO has recommended that intra dermal skin testing should not be used before administering ASV. This test may reveal IgE mediated type I hypersensitive reaction to horse protein but do not predict the large majority of early anaphylactic or late serum sickness type anti venom reactions as they are mediated by direct activation of complement system and not mediated by IgE. 12,13 Skin testing only delay the administration of ASV and can cause sensitization.

About 7.78% of the bites occurred during the period between June to September i.e. during summer and rainy season. As in most studies, the highest incidence corresponds to the months of rainy season when rain water compels the snake to come out of their dwellings and agricultural activity doubles the risk of exposure. Similar climate and time preponderance

sensitized (IgE-mediated Type I hypersensitivity) by a previous exposure to the animal serum, for example, to the equine antivenom, the tetanus immunoglobulin or the rabies-immune globulin. 13

The mean dose of ASV given in our study was 16.99 vials (169.90 ml), which were 512 ml and 900 ml with Sharma et al 10 and Agarwal et al respectively. The total dose and the bolus dose requirement in our study is less than the recommended dose. All this patients had also received anticholinesterase (neostigmine) as in other studies by Bomb B.S. et al. 14

Neostigmine in a dose range of 0.01–0.04 mg/kg every 1–3 hour up to a maximum of 10 mg/24 hour was administered by intramuscular or intravenous route. Patients were observed over 30–60 min for improvement of ptosis. 84% patients in our study responded to neostigmine and showed improvement in ptosis and in rest of the 16% patient neostigmine was discontinued in view of lack of response. Anticholinesterase drugs have a variable, but potentially useful effect in patients with neurotoxic envenoming. 16 Anticholinesterases acts against the postsynaptic toxins (such as those of cobra) that induce a myasthenia-like block. They are not active against toxins acting presynaptically (common Krait). They are also not useful if administered late, as binding of toxin to acetylcholine receptors becomes relatively irreversible with time. Atropine must be given to counteract the unwanted muscarinic side effects of neostigmine.

Immediate endotracheal intubation is necessary for airway protection and prevention of aspiration in patients with bulbar involvement. In our study, patients after intubation were initially ventilated by ambu bag followed by Assist Control mode of ventilation. The mean duration of ventilation was 43.5 hours in this
The patients should be weaned as quickly as possible as there is increased risk of ventilator associated pneumonia with prolonged ventilation. By employing such an early aggressive approach, we aimed to attain early recovery, improve survival and decrease the duration of mechanical ventilation, and also the incidence of associated complications.

Out of 113 patients 95 (84%) patients completely recovered. 18 patients, who died, had sustained irreversible hypoxic-ischemic cerebral injury because of delay in reaching the hospital. On an average, patient stayed in hospital for 7.5 days ranging from a minimum of 2 days to maximum of 13 days.

**Study Limitations**

a. A retrospective analysis was one of the limitations of this study, since some of the important data were incomplete or insufficient and they may not reflect the exact statistics.

b. In the developing countries, most of the patients consult a traditional healer first instead of seeking treatment at the health centers. Many snakebite cases are treated at the primary healthcare centers and they were not referred to the higher centers, thus leading to an underestimation of the morbidity status in the studies which were done at the tertiary healthcare centers.

**Summary**

By this study we conclude that the successful management of neurotoxic snake bite includes administration of initial bolus dose of 10 vials of ASV (and repeat dose of 10 vials of ASV in patients with respiratory distress) given along with neostigmine, atropine and prompt ventilatory support. However, more such studies need to be carried out to formulate a protocol for ASV administration and management of neurotoxic snake bite. Until such a universal protocol has been made, treatment using initial dose of 10 vials of ASV plus another 10 vials in patients with non-improving respiratory distress along with ventilatory support appears to be the most effective treatment protocol.

**References**