ABSTRACT

Introduction: In North India snake bite deaths are predominantly seen with neurotoxic envenomations (NEs) whereas in South India the hemotoxic envenomation (HE) is more common. Krait is responsible for most deaths in North India. It bites people sleeping on the floors, mostly at night. We describe the profile of venomous snake bites over 1 year in 2013.

Materials and Methods: The study was conducted in a rural tertiary care hospital in North India. Demographics, circumstances of bite, envenomation, first aid, delay, consultation, treatment, anti-venom, and outcomes were recorded for all victims of snake bite. We included all consecutive adult (>18 years) venomous snake bite victims admitted from January to December 2013.

Results: A total of 91 patients with venomous snake bites were included in the study. Pure NEs were 41 (45.1%), pure HE in 31 (34.1%), 7 (7.7%) had mixed NE + HE, and 12 (13.2%) had only local swelling. Forty patients (44%) were bitten during sleep presenting as NE (92.5%), NE + HE (5%), and HE (2.5%). Findings in the 51 patients (56%) bitten during activity were HE (58.8%), local swelling (23.5%), NE + HE (9.8%), and NE (7.8%) (P < 0.0001). First aid was sought by 24 NE patients out of which 23 (96%) went to alternate practitioners or religious healers.

Conclusion: Almost all (97.5%) bites during sleep resulted in NE in our study. About 96% of NE sought first aid from alternate practitioners or religious healers in hope of some magical treatment. Thus, a deadly combination of krait bite during sleep and wrong health seeking behavior is responsible for high mortality krait bites in this region. Mass public awareness regarding krait bites can prevent mortality in many such cases.

Key Words: Anti-snake venom, cobra, krait, religious healers, viper

INTRODUCTION

Our hospital receives venomous snake bites with from a surrounding area of 100 km. Most cases occur between May and October. The majority of pure neurotoxic envenomations (NEs) are inflicted during sleep by the kraits. The bite is often painless, and it is not rare to find the patients dead in the morning. Mortality is rare with viper bites that cause hemotoxic envenomation (HE) and occur mostly during activity and daytime. We present the profile of venomous snake bites in a rural tertiary care hospital in North India which is in contrast to the profile in South Indian snake bites.

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MATERIALS AND METHODS

Setting
The study was done in a 787 bedded tertiary care hospital catering to the referred cases from a predominantly rural population in North India. The whole area falls under the Sub-Himalayan belt and includes tribal areas and hilly terrain.

Design
This was hospital-based observational study. We recorded the demographics, circumstances of bite, envenomation, first aid, delay, consultation, treatment, anti-snake venom (ASV), and outcomes of patients with venomous snake bites.

Inclusion criteria
We included all consecutive adult (>18 years) with venomous snake bites admitted in our hospital.

Statistical analysis
The data were analyzed using SPSS software (version 23, SPSS, Inc., Chicago, IL, USA). The continuous variables were expressed as means and standard deviations and categorical variables were expressed as proportions. Comparison of continuous variables was done using t-test and categorical variables were compared using fisher’s exact. An alpha error of 95% was considered significant (P < 0.05%).

Ethics committee approval was obtained before the initiation of the registry, and informed consent was obtained from all the patients or their close relatives.

RESULTS

Total 127 patients of snake bite that were admitted to the medicine wards in 2013 and 91 (71.6%) with envenomation were included in the study. The baseline characteristics of the patients are shown in Table 1.

About 91.2% venomous bites occurred in 6 months from May and October compared to 8.8% bites in rest of the year (P < 0.0001). Bites that were inflicted to the patients during their sleep were 44%, and 97.5% of these had NE whereas, only 18.8% of the patients bitten during activity had NE (P < 0.0001). Since the patients bitten during sleep had a completely different profile than patients bitten during activity, we divided the patients into two groups. Group 1 included snake bites during sleep (SBS), and Group 2 included snake bites during activity (SBA). The comparison of various parameters among SBS and SBA is shown in Table 2.

The SBS group had age and gender distribution comparable with the SBA group. 87.5% bites in the SBS group occurred in 3 months June, July, and August, while in SBA group bites were distributed throughout the year [Table 2]. Patients in SBS group took longer to reach hospital as most were bitten during the night and many of the bites were unnoticed while sleeping [Table 2]. SBS patients had signs of envenomation in the form of ptosis, difficulty in swallowing, difficulty in breathing and neuroparalysis. Ninety-six percent of SBS patients went to alternate practitioners or religious healers instead of allopathic sub-centers or primary health centers for first aid. The need for ventilatory support was higher among the SBS group.

Patients in the SBS group had four deaths (10%) whereas in the SBA group there were three deaths (5.8%). In the SBA group, two out of the three patients who died had NE + HE, and only one patient had pure HE. Thus, out of the seven patients who died, six had NE and only one was pure HE. Thus, patients with NE had higher mortality in our setup. The patient who died of HE was brought >12 h after the snake bite and had respiratory failure, multi-organ dysfunction, and bleeding from many sites when he was brought.

The total dose of ASV given to SBS and SBA groups was 227 ml and 201 ml, respectively.

The snakes with NE were identified as kraits, snakes causing NE + HE were cobras, and snakes with HE were vipers. Based on the profile of the patient, 41 patients presenting as pure NE were presumably bitten by

| Variable | SNAKEBITE DURING SLEEP | SNAKEBITE DURING ACTIVITY | P |
|----------|------------------------|----------------------------|---|
| MALE (%) | 50                     | 47.1                       | 0.83 |
| AGE (YEARS) | 39.5 ± 18.5 | 43.1 ± 15.6 | 0.32 |
| PROPORTION OF BITES BETWEEN JUNE AND AUGUST (%) | 87.5 | 43.1 | 0.001 |
| FIRST AID FROM ALTERNATIVE PRACTITIONERS (%) | 96 | 77.8 | 0.10 |
| TIME FROM BITE TO HOSPITALIZATION (H) | 7.3 ± 3.4 | 4.6 ± 4.2 | 0.001 |
| DOSE OF ANTI-SNAKE VENOM (ML) | 227.0 ± 100.7 | 201.5 ± 117.4 | 0.27 |
| DURATION OF HOSPITAL STAY (DAYS) | 4.0 ± 1.6 | 3.9 ± 1.2 | 0.88 |
| NEED FOR VENTILATOR (%) | 22.5 | 5.9 | 0.02 |
| MORTALITY (%) | 10 | 5.9 | 0.69 |
kraits, 31 patients presenting as pure HE were bitten by vipers, seven patients with mixed NE + HE were bitten by cobras, and 12 patients with local swelling were also most probably vipers.

**DISCUSSION**

Snake-bites by kraits, cobras, and vipers identified as the most common venomous snakes in India. The frequency of snake bites increases during monsoons in India with an increase in morbidity and mortality in the rural community. Our data were analyzed by making two groups SBS and SBA. The groups differ significantly in the type of envenomation and outcomes. SBS was caused exclusively by kraits leading to pure NE. Many patients did not notice the bite and were found paralyzed in the morning. SBA group also had cases of NE, but it was NE + HE indicating a cobra bite. Mortality was associated with NE in 6 (85%) cases, and there was 1 (15%) with HE. The features of pure NE and pure HE are contrastingly different [Table 3].

Other studies from Himachal Pradesh show a similar prevalence of NE over HE,[1,2] Same findings are evident from other North Indian states like Punjab where NE was almost 100% among the venomous snake bite cases.[3] The findings from South India were contrary to North in having HE much more common than NE. Pore et al. from Maharashtra reported HE (75%) and NE (16%).[4] Snake bites in children from rural Maharashtra showed HE in 90.74% and NE in 9.25% cases.[3] Karnataka also showed HE to the tune of 73.68% and NE 19.73%.[5] Kerala had HE as high as 90.4%.[6] Hence, from above review, it can be said that NE is the predominant envenomation in the Northern States while HE is the predominant form of envenomation in the Southern States of India. Reasons for this distribution is yet unknown.

Table 3: Differentiating clinical features of neurotoxic envenomation and hemotoxic envenomation in North India

| Variable                      | Pure neurotoxic envenomation* | Pure hemotoxic envenomation |
|-------------------------------|-------------------------------|-----------------------------|
| Activity                      | Mostly during sleep           | Mostly while awake          |
| Snake involved                | Krait (~95%) rarely cobra     | Vipers                      |
| Seasonal distribution         | Very strong (June to August)  | Weak (all year round with a mild peak in monsoons) |
| Immediate pain and swelling   | No local pain                 | Severe local pain and swelling |
| Onset of systemic envenomation (h) | Within 1-2 | Delayed 12-48 |
| Clinical features             | Posis, dysphagia, respiratory distress, quadriaparesis, early morning neuroparalysis | Gum bleed, renal failure, hematuria, bleeding manifestations |
| Outcome                       | Death if treatment delayed    | High survival even with delayed treatment |

*Cobra bites cause mixed neurotoxic and local features, occurs during activity and is painful and highly fatal

In West Bengal, SBS by krait caused 66% of all deaths due to snakebites.[8] In our study, 44% had SBS whereas in Kerala 93% of 583 venomous bites had outdoor snake bites.[8] Thus, a contrasting difference in the type of snake bites was noticed.

Another interesting feature of krait bites was that 87.5% krait bites occurred between June and August, while the viper bites were distributed throughout the year with a peak during monsoon. Bawaskar et al. from Maharashtra have also reported the similar seasonal distribution of snake bites with regards to vipers and kraits.[8] Pure NE was recorded in 92.5% of SBS compared to 3% of SBA and tells about the nocturnal nature of the snake.

Krait bite being painless goes unnoticed in many cases and patient presents with ptosis, paralysis, dysphagia, and difficulty in speaking in the morning hours. People know that this is the result of krait bite; still they prefer the religious healers and alternative practitioners for first aid (96%) over the government hospitals. This health seeking behavior in this region leads to further delay in anti-snake administration and increases morbidity and mortality. The mortality figures in our study are not representative of mortality in the society. Many patients of krait bite are found dead in the morning and thus missed from the analysis. Only 14% of all deaths due to snakebites occur in-hospital, which is why the National deaths figure in snake bites is skewed.[6] The same situation exists in other parts of India, where 75% of deaths occur at home or after seeking only religious interventions.[8]

HE, on the other hand, is caused by vipers that have a painful bite with local swelling. The patient develops a fear complex and rushes to the hospital. The systemic derangement also is slower to develop, and the patients respond well to ASV. Only one patient with HE died in our study since he presented >12 h after the bite with multi-organ dysfunction and bleeding manifestations.

**CONCLUSION**

We conclude by saying that SBA and SBS are two spectra of snake bites in North India. NE is much more common in North India than South India where HE is more common. Most importantly, public awareness regarding the timely administration of ASV in a patient with early morning neuroparalysis during monsoons is advocated even if there are no fang marks and the snakebite was unnoticed. The information has been shared with the Chief Medical Officer of this area, and a sensitization workshop is planned on the issue of snake bites in the coming season. Mass awareness program using electronic and print media is also planned to help disseminate the information regarding the SBS among the public.
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Conflicts of interest
There are no conflicts of interest.

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