The Unwritten Saga of Acute Kidney Injury (AKI) in Patients of Snakebite – An Observational Study from North Eastern India

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ABSTRACT

BACKGROUND
Snakebite is one of the commonest occupational hazards in our country, especially among the rural population. It leads to a multitude of complications starting from localized cellulitis to even death. AKI is a significant as well as an under reported complication in patients of snake bite which has a tremendous impact on the final outcome. The unfavourable outcome in snake envenomation can be predicted early with the development of AKI. We wanted to assess the clinical profile of snakebite patients and determine the incidence of AKI in patients of snakebite.

METHODS
The study included 92 patients of snakebite admitted in the Department of Medicine, Silchar Medical College & Hospital (SMCH) done over a duration of 24 months. The various data regarding clinical features of the patients, serum creatinine levels, other blood parameters of the patients selected for participation in the study were analysed using simple statistical methods.

RESULTS
Majority of the snakebite victims were males. The commonest site of snake bite was the lower limbs. 17.4 % (n = 16) of the cases developed AKI. The mortality in patients of snakebite developing AKI was 25 % (n = 4).

CONCLUSIONS
Snakebite envenomation is associated with a considerable burden of AKI in the developing countries especially among the rural population. Prompt initiation of aggressive treatment improves the final outcome.

KEYWORDS
Snakebite, Rural Population, AKI, Lower Limbs, Developing Countries

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BACKGROUND

Snakebite is one of the commonest occupational hazards in India especially in rural areas. It leads to multi varied complications starting from localized cellulitis to serious and critical illness and often culminating in even death. The traditional concept of the "Big 4" snakes given medical importance in our country are, the Indian Cobra (*Naja Naja*), the Russell's Viper (*Daboia Russelii*), the Common Krait (*Bungarus Caeruleus*) and the Saw-Scaled Viper (*Echis Carinatus*).[1] However, in the recent past there has been emergence of another species named as the Hump Nosed Pit Viper (*Hypnale Hypnale*) which is equally potent to cause serious and at times lethal envenomation.[1] In India alone, an estimated 2.8 million people become victims of snakebite with almost 46900 fatal cases every year (as per WHO-World Health Organization data).[2]

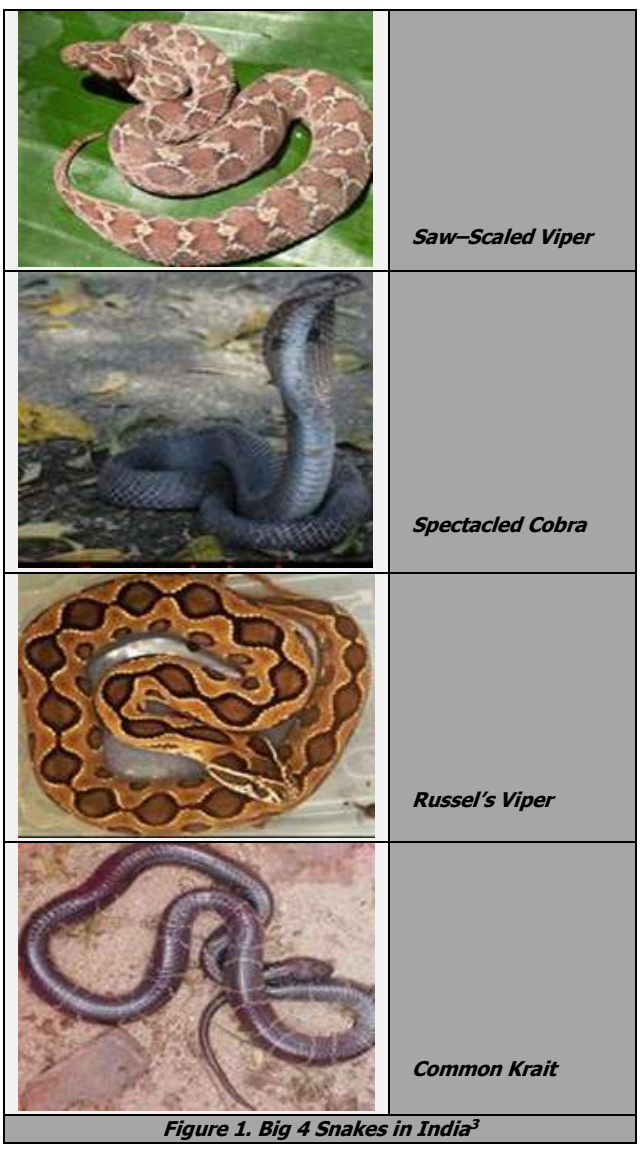

Figure 1. Big 4 Snakes in India[3]

AKI, though a well-known complication of snake bite but till today is a relatively under reported manifestation and which can lead to fatal outcome in numerous cases. The development of AKI in snake envenoming is an ominous sign and can be considered as an early predictor for unfavourable eventuality. The exact mechanism has not been described thoroughly in the world medical literature owing to its probable multi factorial origin. However, there are descriptions of the possible underlying mechanism responsible for causing AKI in cases of snakebite. The possible explanation of AKI in patients of snakebite is acute tubular necrosis in majority of the cases, acute interstitial nephritis and even renal papillary necrosis in some cases.[4] The leading explanation regarding pathogenesis of snakebite induced AKI is elevated oxidative stress and carbonyl stress.[5] Although bites from all the venomous snakes can cause AKI, a considerable chunk of these patients are victims of viper bites.[4]

The present series was undertaken for assessing the clinical profile of snakebite patients and evaluation of the incidence of AKI in cases suffering from snakebite.

METHODS

The present series was a prospective observational one undertaken in the Department of Medicine, SMCH (Silchar Medical College and Hospital), Silchar, Assam, India, and was of 24 months duration commencing from 1st July 2017 and continued till 30th June 2019.

Inclusion Criteria

- Age > 12 years.
- Definitive history of snake bite.
- Clinical picture consistent with snakebite along with supportive history (e.g. fang marks).
- Patients giving written and informed consent.

Exclusion Criteria

- Patients with pre-existing kidney diseases.
- Patients on nephrotoxic drugs.
- Patients not willing to give consent.

All cases satisfying the inclusion criteria admitted in the above setup during the above-mentioned timeline were selected for participation in the study. All the cases underwent a detailed clinical evaluation and were investigated using a standard set of investigations. The measurement of urine output was taken every 6 hours. AKI was diagnosed using KDIGO (Kidney Disease/ Improving Global Outcomes) criterion[5] which defines AKI as the presence of any one of the following: -

- Increase in S. Creatinine by ≥ 0.3 mg / dL (≥ 26.5 µmol / l) within 48 hours; or
- Increase in S. Creatinine to ≥ 1.5 times baseline, which is known or presumed to have occurred within the prior 7 days; or
- Urine volume < 0.5 ml / kg / h for 6 hours.

Serum creatinine was estimated using the VITROS 5600 autoanalyzer. All statistical analyses were done using SPSS version 20.0 software.

RESULTS

The total number of cases with snakebite who met the inclusion criteria for this study was 92. Male preponderance was noted in the incidence of snakebites (n = 76, 82.6 %). The mean age group of the entire study population was 33.2 + 10.9 years. The youngest and oldest cases were 13 years and 66 years respectively.

Sl. No.	Age Group	No. of Cases	Percentage
1	11 - 19 years	10	10.9
2	20 - 29 years	32	34.8
3	30 - 39 years	30	32.6
4	40 - 49 years	12	13.0
5	50 - 59 years	4	4.3
6	60 - 69 years	4	4.3

Table 1. Age Distribution of the Study Population

Majority of the victims were aged between 20 - 29 years (n = 32, 34.8 %) followed by the cases aged between 30 - 39 years (32.6 %) suggesting working class people engaged at outdoor jobs more vulnerable to the risk.

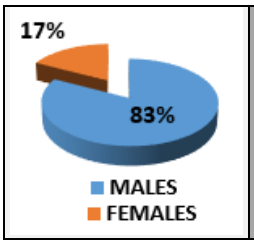

Figure 2. Sex Distribution of the Cases

The commonest site of bite was the lower limbs (n = 66), left leg (n = 38) slightly higher than right leg (n = 28) followed by the hands (n = 22) and 4 patients were bitten on the trunk. The commonest presenting feature was localised swelling with cellulitis observed in 22 cases followed by hypotension in 10 cases. Out of all the cases, 8 patients presented to the hospital with bleeding manifestations. No case in this study had presented with breathing difficulty but during the stay in hospital, 2 patients developed neuroparalysis. A considerable number of the cases had no localised or systemic manifestations and presented with only the definite history of snakebite. (n = 52)

Sl. No.	Presenting Features	No. of Patients	Percentage
1	Pain and Localized Swelling	22	23.9
2	Hypotension	10	10.9
3	Bleeding Manifestations	8	8.7

Table 2. Presenting Features in the Study Population

The 20 minutes Whole Blood Clotting Time (WBCT) was deranged in 22 cases and all the cases were treated with polyvalent Anti Snake Venom (ASV) available in the study setup. No adverse drug reactions were observed anytime during the treatment with ASV in any of the 22 cases put under treatment.

The incidence of AKI in patients of snakebite was 17.4 % (n = 16). Out of the 16 cases who had developed AKI, 14 were males and 2 were females. The mean S. creatinine in the study subjects was 1.48 + 1.2 mg / dL. Out of the cases developing AKI, 6 patients were put on Renal Replacement Therapy (RRT) and 4 patients could not be salvaged and succumbed to envenoming even after being put on RRT. The mortality observed in the patients of snakebite who developed AKI was quite high at 25 % (n = 4). No mortality was seen in the cases with preserved renal functions.

Figure 3. Vial of Polyvalent Anti Snake Venom

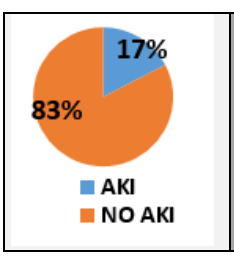

Figure 4. Incidence of AKI in Cases of Snakebite

DISCUSSION

The mean age of the snakebite patients in this study was 33.2 years which is comparable to P Mukhopadhyay et al[6] (36.2 years), Tushar B Patil et al[7] (35.77 years) and N Sharma et al[8] (31.2 years). The male preponderance in the incidence of snakebite observed in this study (82.6 %) is in accordance with the findings of P Mukhopadhyay et al, N Sharma et al and Tushar B Patil et al. The commonest site of snakebite was the lower limbs similar to the series by Mukhopadhyay et al, N Sharma et al and Tushar B Patil et al.

All the venomous species of snakes carry the potential to cause AKI in the general population following a bite.[9] Diagnosing envenomation is in itself a challenge and is mainly a clinical entity due to absence of any diagnostic kits.[10] The incidence of AKI in this study was 17.4 % similar to Tushar B Patil et al (20.48 %) and N Sharma et al (19 %) whereas P Mukhopadhyay et al observed a higher incidence

of AKI at 44.13 %. The mean S. creatinine in the present series was 1.48 + 1.2 mg / dL whereas P Mukhopadhyay et al observed a higher mean creatinine of 4.56 ± 0.24 mg / dL. Many studies have reported that even when the ASV is administered within one to two hours after the snakebite, it was unable to prevent AKI.[11] The mortality of patients suffering from AKI in cases of snakebite in the present series was 25 % which was comparable to P Mukhopadhyay et al (29.7 %) but in contrast to Tushar B Patil et al (15.5 %) and N Sharma et al (3.5 %). The requirement of RRT in cases of snakebite induced AKI in the present series was 37.5 % similar to Mukhopadhyay et al at 33.7 % whereas in the study by Tushar B Patil et al the value stood roughly at around 52 % which was comparatively higher than observed in the present study.

CONCLUSIONS

Snakebite envenomation is associated with a significant burden of AKI in the developing nations especially among the rural population. This hazard subjects the victim to considerable life threatening catastrophes, considerable financial difficulties, devastating disability, progression to chronic kidney disease and even death. It is also important to have a high index of clinical suspicion for possible development of AKI among patients of snakebite. These patients should be managed aggressively by an early intervention targeting reversal of AKI as the cases developing AKI following snakebite have a torrid time in the hospital including a very high mortality. Currently an agenda of supreme importance in a developing nation like India is to educate the masses regarding correct first aid measures in the event of a bite and bringing down the over reliance of people on traditional methods mainly quackery, which have been proven to confer no scientific benefit and is nothing except a mere waste of vital time.

Limitations

This study was a single centred, short durational one covering a limited geographical area having a small sample size. Further large scale multi centric studies covering a wider geographical location taking a bigger sample size and conducted over a longer time period would be ideal to establish concrete facts regarding these potential hazards in the form of AKI in cases of snakebite.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.
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