Clinical profile of snake bites with special reference to acute kidney injury in children

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Abstract

Background: Snake bite is generally considered to be a rural problem and has been linked with environmental and occupational condition. It is a neglected public health problem. Acute kidney injury (AKI) in patients with snake bite is an important cause of mortality and morbidity. The acute renal failure is largely a preventable complication which can be prevented by early hospitalization and monitoring for renal complications.

Objective: To study the clinical profile with special reference to AKI in snake bites in children admitted to KIMS hospital, Hubballi.

Methods: It was a prospective study of 31 patients of snake bite in tertiary care centre in Paediatric Intensive Care Unit in the year Jan 2017- Dec 2017. Clinical data about age, sex, clinical manifestations, complications including acute kidney injury and outcome were measured.

Results: Out of 31 patients, 18 (58.06%) were males. The bites were vasculotoxic in 26(83.87%) and neuroparalytic in 5 (16.12%). Mainly bites occurred from June to September with 13 (41.94%) bites. Bites were more common in males 18 (58.06%) and in age more than 5 years (83.87%) with bite marks mainly on lower limbs in 21 (67.74%) patients; and local pain (96.77%) being the commonest complication. AKI was seen in 10% of patients.

Conclusion: The snake bite is a rural medical emergency. Anti snake venom (ASV) should be a part of the primary health care package in areas where snake bites are common thereby referral to higher centers can be minimized. AKI was common in viper envenomation, and children with bleeding manifestations and delay in treatment were at risk for AKI. The limb must be immobilized, similar to that of a fractured limb, in such a way that it should not block the blood supply. The patient should be made to lie in the recovery position with his/her airway protected to minimize the risk of aspiration of vomitus.

Keywords: Snake Envenomation; Vasculotoxic; Neuroparalytic; Children; Acute Kidney Injury

Introduction

The Snake bite is a common medical emergency and occupational hazard, more so in tropical India, where farming is a major source of employment. WHO, however, predicts as many as 1,841, 000 envenoming and 94,000 deaths globally[1].In India, WHO estimate places the number at 30,000 per annum[2].

Recently the Government of India's Central Bureau of Health Intelligence accounted only 985 snake bite deaths in 2010. Estimates as low as 61,507 bites and 1,124 deaths in 2006 and 76,948 bites and 1,359 deaths in 2007 and as high as 50,000 deaths each year have been published[3]. Annual snake bite mortality in India varies approximately from 1,300 to 50,000.[4]

Snake bite is a recent inclusion to the list of neglected tropical diseases drawn up by the World Health Organization, and it could be the most neglected of all tropical diseases in the 21st century, according to a new analysis. There are about 236 species of snakes in India, out of which most are non poisonous. There are 13 known species that are poisonous apart from the BIG- 4-cobra, Russell's viper, saw scaled viper and common krait [2].

The principal systemic effects of the envenomation are on the nervous system, kidneys, heart and blood coagulation and locally at the site of bite. In India Acute kidney injury incidence following Russell's viper or Echis carinatus snake bite is 13-32%[5]. Mortality

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rate due to AKI is 22%[6].Factors associated with AKI are bite to hospital time, hypotension, albuminuria, prolonged BT, prolonged PT, low haemoglobin and a high total bilirubin[7].

As snake bite is common in this part of Karnataka where farming is a major source of employment and not many epidemiological study has been done in this part of Karnataka in relation to AKI, hence this study has been taken up to know the clinical profile with special reference to AKI in children with snake bites.

Materials and methods:

Following an informed parental consent, clinical history (including history regarding pre-existing renal disease) and examination was done, and relevant data was entered in a structured proforma after applying inclusion and exclusion criteria as follows:

Inclusion criteria:

All patient with at least one of following criteria were included in the study

1. Patients with history of snakebite with features of envenomation or attendees having seen or brought the offending snake.
2. Patients with history of unknown bite but presenting with signs of local or systemic envenomation of snake bites.

Exclusion criteria:

1. Patients with pre-existing renal diseases with history of snake bite.
2. Patients with history indicating risk for developing renal disease with history of snake bite.(diabetes, hypertension, connective tissue diseases, chronic infection)

Relevant investigations were done for all children included in the study. All cases of snake bite were considered to determine the clinical profile whereas for determining the prevalence of Acute Kidney Injury, inclusion and exclusion criteria were applied.

Specific treatment was initiated following initial stabilization as per protocol which includes Anti Snake Venom, Neostigmine, and Atropine, blood products transfusion, ventilator support and dialysis whenever indicated. Local cellulitis was treated with anti-inflammatory agents, antibiotics and with surgical management like fasciotomy whenever indicated. WBCT>20min anytime during the stay period for a patient, was taken under the group WBCT>20min.

Definition of acute kidney injury **[8]**

An abrupt (within 48 h) reduction in kidney function defined as an absolute increase in serum creatinine of more than or equal to 0.3 mg/dl, or an increase in serum creatinine of more than or equal to 1.5-fold from baseline, or a reduction in urine output (documented oliguria of less than 0.5 ml/kg/ h for 6 h).

Serum levels of creatinine were estimated at admission and at intervals of 24hrs after admission for first 3 days. Thereafter, serum creatinine was measured at intervals of 48hrs (or whenever clinically indicated, whichever is earlier) till discharge or death. Urine output was measured and recorded as ml/kg/hour.

Diagnosis and staging of AKI was based on KDIGO (Kidney Disease Improving Global Outcomes) definition & classification. Either serum creatinine or urine output was used to diagnose and stage AKI, using a criterion that leads to higher stage classification.

The patients with AKI were followed up till discharge or death. They were evaluated to ascertain progression, need for dialysis and short term outcome was examined in relation to maximum stage of AKI. Serum creatinine level of those with AKI was done at the time of discharge from hospital to record their recovery status. Complete recovery is defined as normal blood pressure[9] and normal serum creatinine for age (0.2-0.5mg/dL for infants; 0.4-0.9 mg/dL (for 1-12 yr)[10]. Partial recovery is the presence of hypertension[9], or elevated serum creatinine[10].

Statistical analysis*:*

Data was collected in a preformed proforma, entered in Microsoft Excel sheet and statistical analysis was done using R Software. For quantitative data mean, median and standard deviation was calculated. Statistical test like Fischer's exact test was used for comparing difference between categorical variables & Student's t test was used for continuous numerical variables. Cramer's v correlation was done for nominal data. For interpretation of the results significance was adopted at p-value <0.05

Results

Thirty one cases admitted to the Pediatric Intensive Care Unit in the Department of Pediatrics, KIMS Hubballi from 1st January 2017 to 31st December 2017,who fulfilled the inclusion criteria were enrolled into the study. Out of 31 children 18 (58.06%) were male and 13 (41.94%) were female. Male to female ratio in the study population was 1.38:1.The most common age group of snake bite is between 5-10 years

accounting for 45.17 % of the total cases. Median age in our study population was 9years. Out of 31 children, 16 (51.62%) were from lower class, 11 (35.48%) from upper lower class, 2 (6.45%) from lower middle class and 2 (6.45%) from upper middle class as per Modified Kuppuswamy's classification (2017). Out of 31 children majority (67.74%) bites were in lower limb. Mean duration of hospital stay was 2.92±0.64days in cases where the time of bite to hospitalization was less than 6hrs. 17 cases which reported after 6 hours of bite had mean hospital stay of 6.53±3.12days. There is significant association between time of bite to hospitalization to hospital stay. Pain was present in 96.77% cases. Local edema was the next common sign present in 54.83%. Next to that was vomiting in 35.48%, cellulitis and local bleed in 32.25%. There was hypotension in 1 case. Ptosis present in all 5 cases of neuroparayltic snake bites. Out of 31 patients one child died within 8hours of admission. So for distribution of AKI 30 patients were taken. AKI was found in 10% of patients. Among the AKI 2 patients were in stage 1 and one case in stage 3 AKI**.** Patients with AKI with time of bite to hospitalization had no statistical significance. Majority among the AKI were Viper (66.67%). In this study it showed low correlation between AKI & neurotoxicity. Peritoneal dialysis was done in one case among the AKI and one case was intubated for respiratory paralysis. WBCT was more than 20 minutes in all three cases of AKI.

Table 1: Baseline characteristics of the patient among AKI and non AKI group

Variables	AKI (N=3)	Non AKI (N=27)	
Mean Age in years	7(6.5 - 9)	10 (6 - 11)	0.73
Male	2(66.66)	16(59.2)	0.08
Female	1(33.33)	11(40.74)	
Upperlimb	1(33.33)	8(29.6)	0.59
Lowerlimb	2(66.66)	19(70.3)	
WBCT>20min	3	10(37.03)	0.07
WBCT<20min	0	17(62.96)	

Table 2: Time lapse before hospitalization and its relation with hospital stay

Time of Bite to Hospitalization (In Hours)	No of cases	Hospital stay (In days) (Mean + SD)
<6	14	2.92±0.6
>6	17	6.53±3.1

**Student t test, p=0.00011, which is significant*

Table 3: Symptoms and signs among the snake bite patients

Symptoms/signs	Number(%)
Pain	30(96.77%)
Edema	17(54.83%)
Vomiting	11(35.48%)
Bleed	10(32.25%)
Cellulitis	10(32.25%)
Ptosis	5(16.12)

Table 4: Patient with AKI and snakes involved

Type of snake	AKI (N=3)	Percentage (%)
Viper	2	66.67
Unknown	1	33.33

Fisher's exact test* **p value =0.006897, which is significant.

Table 5: Comparison between AKI and complications

Complications	AKI	No AKI	Total
Vasculotoxic	3	23	26
Neurotoxic	0	4	4
Total	3	27	30

**Crammer's v value =0.131, it showed low correlation between AKI & neurotoxicity.*

Table 6: Comparison between WBCT and ASV vials

WBCT	ASV (yes)	ASV (no)	TOTAL
<20 min	5	13	18
>20 min	13	0	13
Total	18	13	31

**Fisher's exact test p value <0.05, p value is significant.*

Discussion

As snake bite is common in this part of Karnataka where farming is a major source of employment and not many epidemiological studies has been done in this part of Karnataka relating to AKI in children, hence this study has been taken up to know the clinical profile with special reference to AKI in children with snake bites.

*Gender***:** Most of the patients were found to be boys (18) in our study accounting for 58.06%. The higher incidence in boys could be due to them being more involved in outdoor activities like farming and risky behavior which is similar to other studies[11-13]. In a study by Usman et al[12] male: female ratio is 1.6:1. In other study by Jayakrishnan et al[14] showed snake bite envenomation occurred more commonly in boys than in girls. Another study by Kshirsagar et al[15] incidence was more in boys (60.49%) as compared to girls

(39.50%). Saborio et al[16] found no significant gender differences.

Age: In the present study, older population was affected more than the younger children and the incidence was more in 5-10yr age group which is an age of maximum ambulation and children of more than 10yrs work at fields. In a study by Lingayat et al[17] the highest incidence at 6-12 yrs could be due to children involved in labor and farm work.

Demographic profile:

Children from lower socioeconomic status constituted 51.62% as per modified Kuppuswamy classification, similar findings were seen in study conducted by Sharma et al,[18] found that urban to rural ratio was 1:4.7. This may be due to different geographical and demographical features of various regions.

Site of bite: Lower limb was bitten in 67.74% cases in the present study whereas it is 79.9% in Kulkarni et al[19] study and 82% in Warrel et al[20] study. In another study by Kshirsagar vv et al[15] 74.04% patients had bite marks on the lower limbs.

Bite to hospital time: In our study 45.1% patients were admitted within 6hr of bite and had lesser mean duration of hospital stay (2.92±0.6) when compared to those arrived later (6.53±3.1). It was noted that patients who had a significantly longer bite to hospital time had a longer mean duration of hospital stay, compared to those who had a lesser bite to hospital time. But it was not statistically significant with respect to duration of stay and AKI in those who presented after 6hours of bite though all 3 cases reached hospital after 6 hours of life.

Athappan et al,[6] found that bite to needle time more than 2 hours (OR 2.10, P = 0.001) was an independent risk factor for the development of AKI. The bite to hospital time depends on the availability of medical facilities and the settings in which the study has been done[7].

Signs & symptoms: In our study pain was present in 96.77% cases, local edema in 54.83%, vomiting in 35.48%, and cellulitis in 32.25%, followed by ptosis in 16.12%. Local edema was present in all patients presenting with vasculotoxic snake bites, but cellulitis was present in only 4 (8%) patients in a study by Sahni et al[21].

Complications: In our study Neuroparalysis seen in 16.1% & 83.87% was vasculotoxic. This can be because vasculotoxic snakes are more predominant in our area. In a study by Jayakrishnan et al[14] reported that neurotoxicity in 26.9%, vasculotoxicity seen in 46.9% & combined in 6.9%. In another study by Lingayat et al[17] quoted that vasculotoxic in 56.75% & neurotoxic in 43.25%.

WBCT & ASV vials: In our study WBCT>20min was seen in 13(41.94%) cases & ASV vials were used for all 13cases. Apart from this ASV were used in 5 other cases were WBCT <20min among which 3 cases of Neuroparalytic & 2cases had rapid extension of swelling above the ankle joint. This study showed statistical significance between WBCT>20min & ASV vials usage.

AKI in snake bite: In our study AKI accounts for (3)10% of total cases among which 2 cases were in stage 1 of AKI and 1case was in stage 3 of AKI and required peritoneal dialysis. All the 3 cases reached hospital after 6hours of bite. In another study by Lingayat et al[17]; only 3.12% had AKI.In our study prevalence was less probably due to lesser number of viper snakes in our place.

In a study by Waikhom et al[22] selected a very homogenous population comprising children who had AKI following Russell's viper bite and 47 (77 %) patients required RRT. In our study also it was found that AKI was following viper in majority 2(66.67%) which is statistically significant.

AKI & neurotoxicity: In our study snakebite patients with neurological signs and symptoms showed no significant correlation with AKI development. This result may be either due to low prevalence of mixed type of snakebite which produces both neurological signs and haematological signs or due to pure neurotoxic snake does not produce haematological complications and AKI. In a study by Paul et al[23], showed presence of neurological signs was negatively correlated with development of AKI.

AKI & WBCT: Athappan et al[6] in their study mentioned that the presence of bleeding manifestations was identified as independent predictors of poor outcome in snakebite patients In our study WBCT was elevated for all the AKI cases but not statistically significant.

AKI & ASV vials: In a study by Paul et al [23], development of AKI was independently associated with 20 min WBCT (P value = 0.029), dark or brown colour urine (P value = 0.000; CI 95%), and time in between snakebite and administration of antisnake venom and AKI was not significantly correlated with local swelling, bleeding from bite site, and amount of ASV given which is similar to our study. In our study mean ASV vials used among the AKI was 12.

Conclusion: The snake bite is a rural medical emergency. The key to minimizing mortality and severe morbidity is the timely and judicious administration of an adequate dose of anti-venom.ASV should be a part of the primary health care package in areas where snake bites are common thereby referral to higher centers can be minimized. AKI was common in viper envenomation, and children with bleeding manifestations and delay in treatment were at risk for AKI. The limb must be immobilized, similar to that of a fractured limb, in such a way that it should not block the blood supply. The patient should be made to lie in the recovery position with his/her airway protected to minimize the risk of aspiration of vomitus.

References

1. *Rana SK, Nanda C, Singh R, Kumar S. Management of snake bite in India-revisited. JK Science. 2015; 17(1):3.*
2. *National snakebite management protocol, India, Directorate General of Health Services, Ministry of Health and Family Welfare, Government of India, 2009.*
3. *Warrell DA. Epidemiology of snake-bite in South-East Asia region. Guidelines for the management of snakebite. New Delhi: WHO regional office for Southeast Asia. 2010:35-45.*
4. *Mohapatra B, Warrell DA, Suraweera W, Bhatia P, Dhingra N, Jotkar RM, Rodriguez PS, Mishra K, Whitaker R, Jha P, Million Death Study Collaborators. Snakebite mortality in India: a nationally representative mortality survey. PLoS neglected tropical diseases. 2011 Apr 12; 5(4):e1018.*
5. *Chugh KS, Pal Y, Chakravarty RN, Datta BN, Mehta R, Sakhuja V, Mandal AK, Sommers SC. Acute renal failure following poisonous snakebite. American Journal of Kidney Diseases. 1984 Jul 1; 4(1):30-8.*
6. *Athappan G, Balaji MV, Navaneethan U, Thirumalikolundusubramanian P. Acute renal failure in snake envenomation: a large prospective study. Saudi Journal of Kidney Diseases and Transplantation. 2008 May 1; 19(3):404.*
7. *Dharod MV, Patil TB, Deshpande AS, Gulhane RV, Patil MB, Bansod YV. Clinical predictors of acute kidney injury following snake bite envenomation. North American journal of medical sciences. 2013Oct; 5(10): 594.*
8. *Kellum JA, Lameire N, Aspelin P, Barsoum RS, Burdmann EA, Goldstein SL, Herzog CA, Joannidis M, Kribben A, Levey AS, MacLeod AM. Kidney disease: improving global outcomes (KDIGO) acute kidney injury work group. KDIGO clinical practice guideline for acute kidney injury. Kidney international supplements. 2012 Mar;2(1):1-38*
9. *National High Blood Pressure Education Program Working Group on High blood Pressure in Children and Adolescents. The Fourth Report on the diagnosis, evaluation and treatment of high blood pressure in children and adolescents. Pediatrics. 2004; 114:555-76.*
10. *Srivastava RN, Bagga A. Diagnostic evaluation. In: Srivastava RN, Bagga A(ed.).Pediatric Nephrology.6th ed. New Delhi: The Health Science Publisher;2016; p.28.*
11. *Shrestha BM. Outcomes of snakebite envenomation in children. Journal of Nepal Paediatric Society. 2011;31(3):192-7.*
12. *Sani UM, Jiya NM, Ibitoye PK, Ahmad MM. Presentation and outcome of snake bite among children in Sokoto, North-Western Nigeria. Sahel medical Journal. 2013 Oct 1;16(4):148.*
13. *Banerjee RN. Poisonous snakes of India, their venoms, symptomatology and treatment of envenomation. In: Ahuja MMS (ed). Progress in Clinical Medicine in India, Vol 2. New Delhi: Arnold- Heinemann 1978;p.136-179*
14. *Jayakrishnan MP, Geeta MG, Krishnakumar P, Rajesh TV, George B. Snake bite mortality in children: beyond bite to needle time. Archives of disease in childhood. 2017 May 1; 102(5):445-9.*
15. *Kshirsagar VY, Ahmed M, Colaco SM. Clinical profile of snake bite in children in rural India. Iranian journal of paediatrics. 2013 Dec;23(6):632*
16. *Saborio P, Gonzalez M, Cambronero M. Snake bite accidents in children in Costa Rica: epidemiology and determination of risk factors in the development of abscess and necrosis. Toxicon: Official Journal of the International Society on Toxicology. 1998 Feb; 36(2):359-66.*
17. *Lingayat AM, Wankhade PR. Study of clinical profile complications and outcome in patients of snake bite in pediatric age group. Int J Healthcare Biomed Res. 2015 Apr; 3(3):203-8.*
18. *Sharma N, Chauhan S, Faruqi S, Bhat P, Varma S. Snake envenomation in a north Indian hospital. Emergency medicine journal. 2005 Feb 1; 22(2):118-20.*
19. *Kulkarni ML, Anees S. Snake venom poisoning: experience with 633 cases. Ind. Pediatr. 1994; 31(10): 1239-1243*
20. *Warrel DA.Venoms, toxins and poisons of animals and plants. In: Wealtherall DJ, Ledingham JGG, Warrell DA (eds.) Oxford Textbook of Medicine. 3rd ed. Vol. 1, Oxford, Oxford University Press; 1996.*
21. *Sahni GS. Clinico-epidemiological profile of snake bite in children-A descriptive study. Indian Journal of Child Health. 2017 Nov 22; 4(4):503-6.*
22. *Waikhom R, Makkar V, Sarkar D, Patil K, Singh A, Bennikal M. Acute kidney injury following Russell's viper bite in the pediatric population: A 6-year experience. Pediatric nephrology. 2013 Dec 1; 28(12):2393-6.*
23. *Paul J, Dasgupta S. Early prediction of acute kidney injury by clinical features of snakebite patients at the time of hospital admission. North American journal of medical sciences. 2012 May; 4(5):216.*

Date received: December 15th 2018
Date accepted: January 17th 2019

Conflict of interest: Nil
Source of funding: Nil