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Renal Parameters as Predictors of Morbidity and Mortality in Snake Bite Patients in a Tertiary Care Hospital in Southern India

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Abstract

Background: Snake bite is predominantly an occupational hazard and a common cause of morbidity and mortality. Acute renal failure has been associated with venomous viper and sea snake bites.AIMS: This study was carried out to study the incidence and clinical profile of the snake bite patients who develop acute renal failure;and to identify the predictors of morbidity and mortality in these patients.Material and methodology: We carried out prospective study on fifty (50) cases of definitive snake bite admitted to Department of Medicine/Emergency medicine, Kempegowda institute of medical sciences, Bangalore from May 2012 to November 2013.Statistical analysis: SPSS for Windows version 17.0 (SPSS, Inc, Chicago, Ill) was used for statistical analysis. The Pearson Chi-Square Test was used to analyze parametric variables. A P value of 0.05 or less was considered statistically significant.

Index terms— snake bite, acute renal failure, oliguria, morbidity, mortality.

1 Introduction

nake bite is predominantly an occupational hazard in the rural tropics and a common cause of morbidity and mortality 1,2 .The majority of victims initially are treated by professional snakebite healers, snake charmers, and religious men, who use herbal remedies, chant divine "mantras," and apply "snake stone," all of which are supposed to magically draw out the venom from the victim 3 . Death often occurs even before the patient can be brought to the hospital.

Globally, at least 421,000 envenomations and 20,000 deaths occur each year due to snake bite. These figures may be as high as 1,841,000 envenomations and 94,000 deaths. Based on the fact that en¬venoming occurs in about one in every four snakebites, be¬tween 1.2 million and 5.5 million snakebites could occur an¬nually 4 . In many parts of Southeast Asian region, snake bite is a familiar occupational hazard of farmers, plantation workers and others, resulting in tens of thousands of deaths each year and innumerable cases of chronic physical handi¬cap **??** . India accounts for about 30,000 deaths per year due to snake bite 6 .

More than 2,700 species of snakes are recognized the world over, but only about 450 of these have front fangs that make them capable of injecting venom during the bite7. The venomous snakes belong to four families: Elapidae, Viperidae, Hydrophiidae, and Colubridae.

Elapids are land snakes, the venom of which contains a high concentration of neurotoxins. The elapids, encountered in Africa and Asia 7 include cobras, kraits, mambas, and coral snakes. Renal involvement is uncommon in victims of bites from members of this family.

Vipers include the Russell's viper, Echis carinatus (sawscaled viper), puff adder, pit vipers, and rattlesnakes. The vipers are the most widely distributed species. Russell's viper is found in India, Burma, Pakistan, Thailand, and other areas of Asia; Echis carinatus in Africa, India, Pakistan, Sri Lanka, and the middle east; and the puff adder (Bitis arietans) in Africa The carpet or saw-scaled viper, Echis carinatus, justifiably can be labeled the most dangerous snake in the world. The factors contributing to its deadliness are its widespread distribution, abundance in farming areas, diurnal habits, good camouflage, and its highly toxic venom.

Hydrophid or sea snake bites are reported mainly among fishing folk of Malaysia, Thailand, and western pacific coastal areas ??,11,12,13,14. Sea snake venom is primarily myotoxic.

Colubrids include the boomsiang (Dispholidus typus), and the bird snake (Thelotornis kirtlandi), which are back-fanged African species. Back-fanged colubrids are usually harmless to humans but are occasionally known to cause serious and fatal poisoning 2 .

Renal lesions have been associated with bites from members of the last 3 families, including the Russell's viper ??5-19, Echis carinatus ??0,16,18, puff adder 20,21 , pit viper 22,23,24,25 and sea snake ??1,12 .

Acute renal failure (ARF), the most significant of all the renal manifestations, has been reported with varying frequency in different studies. . In India, the most widely distributed vipers are Echis carinatus and Russell's viper 3. Most Indian patients are victims of Russell's viper or Echis Carinatus bites15-21

In India, the incidence of ARF is 13% to 32% following Echis carinatus or Russell's viper bite 16, ??8, ??9 .

A variety of histopathological findings have been described in snake bite patients. The most common of them have Acute tubular necrosis 3,7-9,30, Acute cortical necrosis 31 ,Acute diffuse interstitial nephritis 32,33, Proliferative glomerulonephritis. ??4 .

The aim of this study were to describe the incidence and clinical profile of the snake bite patients who develop acute renal failure; and to identify the predictors of morbidity and mortality in these patients.

2 II.

3 Materials and Methods

Fifty (50) cases of definitive snake bite consecutively admitted to Department of Medicine/Emergency medicine, Kempegowda institute of medical sciences, Bangalore from May 2012 to November 2013 were taken up in this prospective obsvervational study. a) Inclusion Criteria 1. Definitive history of snake bite 2. Clinical picture consistent with snake bite, as presence of fang marks or cellulitis or coagulopathy or neuroparaly¬sis 3. Presence of Acute Renal Failure, defined as an abrupt (within 48 hours) absolute increase in the t t t . baseline value measured after admission to our hospital or elsewhere after snake bite, before referral to our hospital, or a percentage increase in t t t t t above base¬line, or oliguria of less than 0.5 mL/kg per hour for more than six hours .Serum creatinine more than 1.5 mg/dL or oli¬guria (urine output less than 400 mL/day)35. b) Exclusion Criteria 1. Patients with pre-existent renal disease (Serum creatinine $>$ 1.5 mg/dL prior to snake bite or ultrasonography of abdomen suggestive of bilateral small kidneys/loss of corticomedullary differentiation / obstruc¬tive nephropathy/other renal pathology) 2. Diagnosed cases of hypertension/diabetes mellitus 3. Exposure to nephrotoxic drugs/toxins. Data was collected by using pre-tested proforma meeting the objectives of the study. Purpose of the study was carefully explained to the patients and consent was taken.

All patients were interviewed, detailed history was taken with respect to risk factors and detailed physical examination were carried out. Appropriate investigations were carried out.

Laboratory investigations in¬cluded hemoglobin, total and differential leucocyte counts, platelet counts, red cell counts, bleeding and clotting time, coagulation profile including prothrombin time, activated partial thromboplastin time and international normalised ra¬tio (INR), urine microscopy, urinary protein, kidney and liver function tests and serum electrolytes. Radiological investi¬gations included X-ray chest and ultrasonography of abdo¬men.

Statistical analysis: SPSS for Windows version 17.0 (SPSS, Inc, Chicago, Ill) was used for statistical analysis. The Pearson Chi-Square Test was used to analyze parametric variables. A P value of 0.05 or less was considered statistically significant.

4 III.

5 Results

During the study period of 18 months a total of 50 patients were admitted for snake bite, out of which 36(72%) were males and the male: female was 2.5:1.A majority were from rural areas 37(74%) and the rest from urban areas 13(26%). The mean age of the male patients was 41.81 years and that of the female patients was 48.29 years.

A majority of the patients were farmers (54 %), labourers (18%) and housewife (16 %).The biting species identified were viper (70%),cobra (6%) and unknown species (14%).

The peak incidence in the snake bite cases occurred during the months of july to September. Most of the patients were bitten during the day time (78%).The most frequently bitten site was the lower extremity (70%).

Definitive fang marks were seen in (66%) of the cases. Tourniquet was applied in (10%) of patients.Cellulitis was seen in patients, out of which patients developed compartment syndrome, requiring fasciotomy.

Only 12% of patients presented to hospital within 2 hours of bite and the mean lapse of time from bite to hospitalisation in males was 17. ??9 Laboratory data showed anemia (hemoglobin$<$10gm%) in 13(26%), leucocytosis in 32(64%), thrombocytopenia in 24(48%), coagulopathy in 18(36%), hematuria in 20(40%), proteinuria in 26(52%), and hyperkalemia in 9(18%) .

Mean urine output at baseline, 24hrs, 48hrs and 72hrs were 651.37 ml, 1436.59 ml, 1751.46 ml and 1956.22 ml. Mean Blood urea at baseline, 24hrs, 48hrs and 72hrs were 44.66 mgs%, 53.71mgs%,51.49 mgs% and 47.86

mgs% and mean serum creatinine at baseline, 24hrs, 48hrs and 72hrs were 1.641mgs%, 1.827mgs%,1.756mgs% and 1.780 mgs% respectively.

There was no significant between group differences in creatinine between those with INR<1.5 and INR>1.5

Out of these 50 patients, 20(40%) patients developed acute kidney injury and 13(26%) required hemodialysis and 1 patient progressed to chronic kidney disease. The mortality rate was 4%.

6 IV.

7 Discussion

Snakebite is a common medical emergency and an occupational hazard. Renal manifestations include proteinuria, hematuria, pigmenturia, and acute renal failure.

In India, the incidence of ARF is 13% to 32% following Echis carinatus or Russell's viper bite **??**6, 28, 29. A variety of histopathological findings have been described in snake bite patients.The most common of them have Acute tubular necrosis 3,7-9,30, Acute cortical necrosis 31, Acute diffuse interstitial nephritis 32, 33, Proliferative glomerulonephritis. **??**4 .

Most of the patients were found to be men in working age group, especially from rural population. Majority of the snake bites occurred between 6 am to 6 pm, i.e., during working hours in the field. As expected, the snake bites more commonly involving lower limbs. So, this also shows that use of protective footwear can reduce the snake bites.

In our study, out of 50 number of snake bite patients, 20(40%) patients developed acute renal failure. This prevalence is higher compared to the other studies from India 16, **??**8, **??**9 . The higher prevalence probably due to higher number of viper bites and delay in administration of ASV, as there is a delay in taking the patient to hospital after snake bite. 45(90%) of the patients had local cellulitis, indicating the vasculotoxic nature of envenomation.

There was a significant increase in duration of hospitalization in those with Creatinine >1.5 (18 days) compared to those with creatinine<1.5 (32 days).

The other common symptoms were swelling/inflammation of bite area (90%), muscle pain/tenderness (60%), oliguria (50%), fever (26%) and vomiting(26%), hematuria(40%) and bleeding from site was present in 40% patients. Similar figures have been reported previously also **??**8 .

Common findings on examination were tachycardia (38%), breathlessness (34%), and hypotension (36%) and Proteinuria (52%) patients. Common laboratory findings were Anaemia (26%);, Leucocytosis (64%); Thrombocytopenia(48%), Coagulopathy (36%). Coagulopathy is an important factor contributing to increased mortality. The prevalence of coagulopathy in this study (36%) is comparable to that noted by Athappan et al 39 i.e., 27.7%, whereas it is less as compared to other series (60-80%) **??**0 . By itself, coagulopathy is a marker of the vasculotoxicity and hemotoxicity of the poison, which means that these patients will have nephrotoxicity due to damage to renal microvasculature. Also coagulopathy leads to bleeding and hypotension which, further leads to renal insufficiency as a result of prerenal insult.

The mortality of snake bite induced acute renal failure is found to be 4% in this study. This is less compared to estimates from other studies from India (22-50%) 39 . Kalantri et al reported an overall mortality of 11% in venomous snake bite patients 41 . The mortality can be prevented by intervention at various levels, which include early transfer of the patient to a primary health care facility, where ASV should be administered at the earliest. The high risk patients should be identified early and referred to higher centre.

The limitations of this study were a smaller sample size and lack of investigations like renal biopsy.

This study concludes that acute renal failure occurs in 40% victims of snake bite and is associated with significant increase in the number of hospilisation days. Common manifestations in¬clude cellulitis, oliguria, proteinuria, coagulopathy and thrombocytopenia. The overall mortality of snake bite in¬duced acute renal failure is 4%. Presence of coagulopa¬thy and increase in the number of hospitisation days are predictors of morbidity and mortality in snake bite patients who develop acute renal failure. [1]

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Figure 1: Table 1 :

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Hematological parameters	Number of patients	%
Hemoglobin (Hb in gms)		
<10.0%	13	26
>10.0%	37	74
Total count(/mm3)		
<11000	18	36
>11000	32	64
Platelet count(/mm3)		
<100000	24	48
>100000	26	52
Prothrombin time (in secs)		
< 15 sec	11	22
>15 sec	39	78
Activated partial thromboplastin time(APTT in secs)		
< 30 sec	9	18
>30 sec	41	82
INR		
< 1.5	26	52
>1.5	24	48
Fibrin degradation products(FDP)		
Positive	22	44
Negative	28	56

Figure 2: Table 2 :

3

Sr creatinine	No patients	%
<1.5	30	60
>1.5	20	40

Table 4 : WBCT in minutes of patients studied

WBCT in minutes	Number of patients	%
<20 min	14	28
>20 min	36	72
Total	50	100

Figure 3: Table 3 :

5

End results	No of patients	%
Discharged	47	94
Death	2	4
Chronic kidney disease	1	2

Figure 4: Table 5 :

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Sr .Creatinine	Number of hospitalization days	% Mean SD		P value
<1.5*	32	64	9.887.534	0.003
>1.5*	18	36 15.94	4.659	0.001
p<0.005				

Figure 5: Table 6 :

7

Blood urea	Mean ± SD	P value
Baseline	44.66 ± 32.677	0.180
24hrs	53.71 ± 39.688	0.90
2 nd day	51.49 ± 42.390	0.186
3 rd day	47.86 ± 45.155	0.105

Figure 6: Table 7 :

8

		48hrs	1.756 ± 1.545	0.188
		72hrs	1.780 ± 1.639	0.201
Serum creatinine	Mean ± SD	P value from Baseline		
Baseline	1.641± 1.319	0.091		
24hrs	1.827 ± 1.362	0.076		

Figure 7: Table 8 :

9

	Urine output	Mean ± SD	P value from Baseline
	Baseline	651.37 ± 509.825	0.074
	24hrs	1436.59 ± 784.178	0.318
	48hrs	1751.46 ± 923.601	0.564
	72hrs	1956.22 ± 1331.394	0.913

Table no 10 : INR VS Serum Creatinine

INR<1.5	Serum creatinine						
Baseline		24hrs		48hrs		72hrs	
Mean±SD	P value	Mean±SD	P value	Mean±SD	P value	Mean±SD	P value
1.55±1.48	1.000	1.54±1.17	1.000	1.39±0.87	1.000	1.43±1.17	1.000
INR>1.5							
Mean±SD	P value	Mean±SD	P value	Mean±SD	P value	Mean±SD	P value
1.91±1.5	0.071	2.26±1.69	0.071	2.34±2.1	0.352	2.25±2.09	0.728

Figure 8: Table 9 :

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