ISSN: 2572-3286

Omer and Alhomrany. J Clin Nephrol Ren Care 2022, 8:074
DOI: 10.23937/2572-3286.1510074
Volume 8 | Issue 2
Open Access

Journal of
Clinical Nephrology and Renal Care

RESEARCH ARTICLE

Renal Involvement Following Snake Bite Envenomation

Haider Omer and Abdulmalik Alhomrany*

Department of Internal Medicine, College of Medicine, King Khalid University, Saudi Arabia

***Corresponding author:** *Dr. Abdulmalik Alhomrany, Department of Internal Medicine, College of Medicine, King Khalid University, P.O. Box 641, Abha, Saudi Arabia*

Abstract

Aim: This study aimed to determine the frequency of renal involvement following snake envenomation and the risk factors that contribute to the development of such complications.

Methods: This retrospective study was carried out at Asir Central Hospital, a tertiary and referral hospital located in the southern part of Saudi Arabia.

Results: Overall, 134 cases of snakebite were identified during the 5-year period of 2015–2019. These included 100 male and 34 female patients, with a mean age of 30 ± 19 y. Hematuria and mild proteinuria were observed in 19.7% and 39.4% cases, respectively. Acute kidney injury (AKI) occurred in 17 cases (12.7%) and supportive renal replacement therapy was required in 4 cases. The cause of renal failure was based mainly on clinical ground with 6 cases due to pre-renal (volume loss due to bleeding) and 10 due to tubulo-interstitial lesions; one case presented with heavy proteinuria and hematuria, and glomerulonephritis was suspected. Full recovery occurred in 15 cases (88.2%), while a partial recovery with permanent damage was observed in 2 cases (11.8%) after follow-up for 24 months. Older age, duration of symptoms before treatment initiated (for instance, late presentation to the hospital), and abnormal coagulation in the form of disseminated intravascular coagulation (DIC) carry higher risk factors for the development of acute kidney injures (AKI).

Conclusions: In this study, AKI occurred in 12.7% victims of snakebite. Hemodialysis and supportive treatment appear to be the mainstay of the therapy in cases complicated with renal failure.

Keywords

Snakebite, AKI, Saudi Arabia, Dialysis

Introduction

Snakebite is a common health problem in the tropics [1]. The actual incidence is not well known and varies from one region to another. Venomous snakes belong to four families: Atractaspidae, Elapidae, Viperidae, and Hydrophiadae. Different types of Russel viper are commonly found in southern part of Saudi Arabia [1,2]. Viper bites are more common than other venomous snakebites in humans. The World Health Organization (WHO) has estimated that approximately 1,25,000 deaths are observed among 2,50,000 cases of venomous snake bites worldwide every year, with India accounting for 10,000 deaths [3]. Several systemic effects of venom were reported such as coagulopathy, neurological abnormalities, musculo-skeletal defect, and renal failure. Acute kidney injury (AKI) is an important consequence of snakebite, and its proper supportive management after the anti-venom administration is of utmost importance for good patient outcome [4]. The incidence of snakebite is not well studied in Saudi Arabia, and only few reports regarding the general features of a snakebite have been published. Alsadoon, et al. have published a report reviewing the number of cases of snakebite over four years, and found 14,679 cases of snakebites were reported during the four-year study period, with a higher prevalence in males (80%) in their productive age. Most patients were within the age group of 25-44 years followed by 44-64 years. The majority of snakebite affected inhabitants were reported from farms of the rural areas, commonly during night hours of spring and summer seasons when snakes are very active. Only 36 (0.24%) patients out of 14,679 were reported dead and 14,643 (99.63%) were discharged after treatment [5]. Although, renal involvement is a well-known presentation only case reports were published from Saudi Arabia [5,6].

We conducted a retrospective study at Asir Central

Citation: Omer H, Alhomrany A (2022) Renal Involvement Following Snake Bite Envenomation. J Clin Nephrol Ren Care 8:074. doi.org/10.23937/2572-3286.1510074

Accepted: July 26, 2022: **Published:** July 28, 2022

Hospital, a tertiary and referral hospital located in the southern part of Saudi Arabia where snake envenomation is a common medical health problem. The aim of the study was to determine the frequency of renal involvement following snake envenomation and the risk factors that contribute to the development of such complications.

Material and Methods

All cases hospitalized due to snakebite between 2015 and 2019 were included. Medical records of all cases were reviewed for demographical data, time of admission after being bitten by snake, clinical presentation and all laboratory data on admission, during hospitalization, and at the time of discharge. Treatment data was also assessed and any information regarding the type of snake was obtained. A clinical history was obtained and a complete physical examination performed in each case. The laboratory investigations included serum creatinine, blood urea nitrogen, electrolytes, hemoglobin, total and differential leucocyte counts, platelet counts, red cell counts, bleeding and clotting times, the coagulation profile [including prothrombin time, activated partial thromboplastin time, and international normalized ratio (INR)], urine microscopy, urine albumin, liver function tests, and 24 h urine collection for protein. The radiological investigations included chest radiography and ultrasonography of the abdomen.

Inclusion criteria

1. A clear history of snake bite.
2. A clinical and laboratory features consistent with that of a snake bite, such as the presence of fang marks, cellulitis, coagulopathy.
3. The occurrence of AKI, defined as sudden onset within 48 hours or absolute increase in the serum creatinine concentration 0.3 mg/dL from the baseline measured at the time of admission, or a percentage increase in the serum creatinine concentration of 0.50 percent above the baseline, or presence of oliguria of less than 0.5 mL/kg per h for more than 6 hours.

Exclusion criteria

1. The patients with a pre-existing renal disease (Serum creatinine > 1.5 mg/dL prior to the snakebite or ultrasonography of the kidneys, suggestive of chronic kidney diseases.
2. Exposure to nephrotoxic drugs or toxins.

With regards to our management protocol, all admitted patients received tetanus toxoid, Anti-Snake Venom (ASV) was administered in a dose of 5 vials (50 mL) in mild cases, in a dose of 5-10 vials (50-100 mL) in moderate cases, and in a dose of 10-20 vials (100-200 mL) as an intravenous infusion in a drip for over 30 min. Antibiotics and diuretics were administered, as indicated. Transfusions of blood and blood products were performed in the indicated patients. Hemodialysis was initiated in four patients. The patients were followed up until they were discharged or until they died.

Statistical analysis

Student's t-test and *Chi-square test* were used to compare those who developed renal involvement with those who did not. Data was analyzed using *SPSS* software (SPSS Statistics for Windows, Version 19.0. Armonk, NY: IBM Corp.).

Results

Overall, 134 cases of snake bites were identified during the 5-year period. This included 100 male and 34 female patients. The mean age was 30 ± 19 yrs. Table 1 shows the common symptoms and signs at presentation. Laboratory findings are presented in Table 2. Hematuria and mild proteinuria were observed in 19.7% and 39.4% cases, respectively (Table 3). Renal

Table 1: Common symptoms and signs of snakebite seen in the study group (134 cases) M = 100 (74.6%); F = 34 (25.4%).

Symptoms and Signs	n (%)
Symptoms	
Local pain	134 (100)
Local swelling	128 (97)
Vomiting	38 (28.8)
Bleeding	24 (18.2)
Headache	8 (6.1)
Signs	
Local tenderness	102 (77.3)
Local redness	48 (36.4)
Local blisters	14 (10.6)
Local lymphadenitis	10 (7.6)
Local abscess	8 (6.1)

Table 2: Laboratory findings of 134 cases of snakebites.

Tests and Laboratory findings	n (%)
Leukocytosis, WBC > 10 × 10^9/L	64 (48.5)
Thrombocytopenia, platelets < 100 × 10^9/L	24 (18.2)
Prolonged PT, > 3 sec. above control	48 (36.4)
Prolonged APTT, > 10 sec. above control	30 (22.7)
Low fibrinogen, < 2.0 g/L	18 (13.6)
High FDP, > 40 mg/L	18 (13.6)
Elevated SGOT (AST), > 30 U/L	24 (18.2)
Elevated SGPT (ALT), > 30 U/L	8 (6.0)
Elevated CPK, >200 U/L	22 (16.7)
Elevated LDH, > 450 U/L	14 (10.6)
Elevated bilirubin, > 20 µmol/L	10 (7.6)
Mild albuminuria (Dipstick)	52 (39.4)
Hematuria, > 10 RBC/HPF	26 (19.7)
Granular cast in urine	24 (18.2)

Table 3: Renal involvement following snakebite.

	n (%)
Acute kidney injury (AKI)	17 (12.7)
Dialysis	4 Patients (Duration 9.8 ± 4.1 days)
Causes of renal impairment (Clinical diagnosis)	
Pre-renal	6 (35.3%)
Tubulo-interstitial	10 (39)
Suspected glomerulonephritis	1 (5.8)
Outcome of renal impairment	
Full recovery	15 (88.2)
Partial recovery	2 (11.8)

Table 4: Risk factors of AKI following snake bite.

Factors	AKI	Non-AKI	*P-value*
Age	35.06 ± 18.25	21.12 ± 16.2	0.023
Duration of symptoms	11.4 ± 18.9	5.8 ± 8.73	0.006
Presence of bleeding	41.2%	13.7%	0.001
Oliguria	23.5%	9%	0.005
Anuria	11.8%	0	0.012
Jaundice	11.8%	0	0.013
Hemoglobin	10.9 ± 4.2	13.0 ± 2.5	0.011
Platelets	121.8 ± 71.8	222.2 ± 114.2	0.003
PT	67.5 ± 20	30.7 ± 15	0.025
PTT	117.5 ± 50	59 ± 30	0.024
SGPT	184.7 ± 80	29.9 ± 10	0.017
SGOT	132.2 ± 70	39.9 ± 20	0.022
Indirect bilirubin	3.2 ± 2.5	0.8 ± 0.5	0.001
LDH	1009.71 ± 100	370.11 ± 90	0.005

impairment (AKI) occurred in 17 cases (12.7%) and supportive renal replacement therapy was required in four cases. The cause of renal failure was based mainly on clinical ground: Six cases due to pre-renal (volume loss secondary to bleeding), 10 due to tubulo-interstitial lesions and one case presented with heavy proteinuria and hematuria and glomerulonephritis was suspected. Kidney biopsy was not performed because of the bleeding tendencies in some patients and rapid recovery in majority of the cases. Full recovery was seen in 15 cases (88.2%) and partial recovery with permanent damage was observed in two cases (11.8%) after follow up for 24 months. The two cases continue to be under follow-up with average serum creatinine of 2.5 mg/dL. Both cases were referred for kidney biopsy but the patients refused. Risk factors for development of AKI was analyzed (Table 4) and the results indicate that the most important risk factors of development of AKI are older age, duration of symptoms before treatment initiated, that is, the late presentation to hospital and the abnormal coagulation in form of disseminated intravascular coagulation (DIC).

Discussion

More than 2000 species of snakes are known worldwide; however, only around 400 of these snakes are venomous [5]. These snakes belong to four families: Elapidae, Viperidae, Hydrophidae, and Colubridae [5]. Renal involvement was observed following bites from members of the latter three families, including Russell's viper, *Echiscarinatus* [7-9]. The most important complication reported was AKI which has been seen with varying frequency in different studies [10-13]. Although most of the venomous snakes are known to cause AKI, the vast majority of these cases were due to viper bites [10]. The precise incidence in different countries is lacking but obviously varies from one place to another due to the distribution of types of venomous snakes. In India, as an example, the incidence of AKI is reported to be as high as 13%-32% following *Echiscarinatus* or Russell's viper bite [10]. While, in Nigeria, the reported incidence rate of AKI after *Echiscarinatus* bite is 1% and following Puff adder bite is 10% [9,10]; in Israel it is 6.2% following Palestinian viper bite [11], in Thailand it is 5% following Russell's viper and sea snake bite [12] and in Ceylon the reported incidence of AKI following bite of unidentified vipers is 27% [12].

Renal involvement following snakebite in Saudi Arabia is not well documented.

Case reports have shown that hematuria and proteinuria are the commonest renal abnormalities found in 20% -70% of the reported cases, respectively [14]. Oliguria or anuria may develop within a few hours, to as late as 96 h, after the bite [15].

It is not a common practice to perform kidney biopsy in these cases because of the rapid renal recovery and or the presence of abnormal coagulopathy that hinder studying the pathological feature of the renal involvement. Reports that managed to do pathological studies have shown that tubulointerstitial lesions, mainly tubular necrosis, is observed in 60%-80% of patients who develop AKI following snake bite [14-18].

AKI is a well-known risk factor for the development of Chronic kidney disease (CKD) in long-term and limited data is available regarding the long-term outcome in patients who develop AKI following envenomation. Priyamvada, et al. showed that one third of their case series developed adverse renal outcomes on long-term follow-up [17]. Herath, et al. reported that 37% of patients who develop AKI following envenomation develop CKD by the end of one year [18]. The main characteristic of these patients was old age group, and majority of them had history of comorbid conditions such as hypertension and diabetes. Both conditions were considered as independent risk factors for the development of CKD [19]. Similar observation was reported by Waikhom, et al., 41% of their patients who sustain envenomation develop persistent renal abnormalities in the long-term follow-up [19]. The patients who developed adverse renal outcomes in their report were older and had a lower Glomerular filtration rate (GFR) at the time of hospital discharge. Hemodynamic alterations caused by vasoactive mediators, cytokines, and direct nephrotoxicity play important role in the development of nephropathy. Hemorrhage, hypotension, disseminated intravascular coagulation (DIC), intravascular hemolysis, and rhabdomyolysis increase renal ischemia leading to AKI [20,21]. Vikrant, et al. reported the pathological abnormalities following snake severe snake bite envenomation. Tubular necrosis, cortical necrosis, interstitial nephritis, glomerulonephritis, and vasculitis were the main findings [21].

In conclusion, renal manifestations among patients with snake envenomation include reduced urine volume, proteinuria, hematuria, electrolytes abnormalities and AKI. Factors associated with the development of AKI include bites from snakes of the family Viperidae, duration from bite to receipt of anti-venom of more than ≥ 2 hours, leukocytosis, overt DIC, rhabdomyolysis, hyponatremia and presence of microscopic hematuria.

Our findings support the hypothesis of multifactorial involvement in the pathogenesis of AKI after sustaining Viperidae bites. These findings should help the treating physicians to provide optimal management for patients at risk of development of AKI in order to reduce the incidence of AKI in tropical countries.

Declaration

NA.

Conflict of Interest

The authors declare no conflict of interest and received no financial funding for this paper.

References

1. Adhisivam B, Mahadevan S (2006) Snakebite envenomation in India: A rural medical emergency. Indian Pediatr 43: 553-554.
2. Asawale K, Katre R, Uike PS (2018) Retrospective study of case profile amongst snake bite patients managed at a tertiary care centre situated in a tribal district of Maharashtra during a span of three consecutive years. International Journal of Scientific Research 7: 45-47.
3. World Health Organization (2021) Snakebite envenoming.
4. Harshavardhan L, Lokesh AJ, Tejeshwari HL, Halesha BR, Metri SS (2013) A study on the acute kidney injury in snake bite victims in a tertiary care centre. J Clin Diagn Res 7: 853-856.
5. Al-Sadoon MK, Albeshr MF, Paray BA, Al-Mfarij AR (2021) Envenomation and the bite rate by venomous snakes in the kingdom of Saudi Arabia over the period (2015-2018). Saudi J Biol Sci 28: 582-586.
6. Al-Homrany M (1996) Acute renal failure following snake bite: Case report and review. Saudi J Kidney Dis Transpl 7: 309-312.
7. Reid H (1982) Animal poisons. In: Manson B, Manson's Tropical Diseases. Balliere Tindall, London, 544-566.
8. Warrell DA, Davidson NMcD, Greenwood BM, Ormerod LD, Pope HM (1977) Poisoning by bites of the saw scaled or carpet viper (*Echis carinatus*) in Nigeria. Q J Med 46: 33-62.
9. Sitprija V, Boonpucknavig V (1979) Snake venoms and nephrotoxicity. Springer Verlag, Berlin, 997-1018.
10. Chugh KS (1987) Etiopathogenesis of acute renal failure in the tropics. Ann Natl Acad Sci 23: 88-99.
11. Efrati P, Reif L (1953) Clinical and pathological observation on sixty-five cases of viper bite in Israel. Am J Trop Med Hyg 2: 1085-1108.
12. Chugh KS, Aikat BK, Sharma BK, Dash SC, Mathew MT, et al. (1975) Acute renal failure following snakebite. Am J Trop Med Hyg 24: 692-697.
13. Tchaou BA, Savi de Tové KM, N'Vènonfon CFT, Mfin PK, Aguemon AR, et al. (2020) Acute kidney failure following severe viper envenomation: Clinical, biological and ultrasonographic aspects. J Venom Anim Toxins Incl Trop Dis 26: e20200059.
14. Al-Homrany MA (1998) Acute renal failure due to snake-bite: Clinical aspects. Saudi J Kidney Dis Transpl 9: 285-289.
15. Tilbury C, Madkour M, Saltissi D, Suleiman M (1987) Acute renal failure following the bite of Burton's carpet viper Echics caxinatus gunther in Saudi Arabia: Case report and review. Saudi Med J 8: 87-95.

16. Al-Mohareb F, Al-Sadoon M (1994) Outcome of snakebites in Al Baha district. Ann Saudi Med 14: 26-29.

17. Priyamvada PS, Jaswanth C, Zachariah B, Haridasan S, Parameswaran S, et al. (2019) Prognosis and long-term outcomes of acute kidney injury due to snake envenomation. Clin Kidney J 13: 564-570.

18. Herath HMNJ, Wazil AWM, Abeysekara DTDJ, Jeewani NDC, Weerakoon KGAD, et al. (2012) Chronic kidney disease in snake envenomed patients with acute kidney injury in Sri Lanka: A descriptive study. Postgrad Med J 88: 138-142.

19. Waikhom R, Sircar D, Patil K, Bennikal M, Gupta SD, et al. (2012) Long-term renal outcome of snake bite and acute kidney injury: A single-center experience. Ren Fail 34: 271-274.

20. Kumar M, Thanjan MA, Gopalakrishnan N, Jeyachandran D, Thanigachalam D, et al. (2022) Snake envenomation-induced acute kidney injury: Prognosis and long-term renal outcomes. Postgrad Med J 98: 264-268.

21. Vikrant S, Jaryal A, Parashar A (2017) Clinicopathological spectrum of snake bite-induced acute kidney injury from India. World J Nephrol 6: 150-161.