Original Article

Clinical Study of Acute Kidney Injury in Tropics with Special Reference to Malaria

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Abstract

Introduction: Acute kidney injury (AKI) is characterized by a reversible decline in the glomerular filtration rate, leading to retention of nitrogenous waste products and an inability to maintain fluid and electrolyte homeostasis.

Aim: This study aims to know the etiology, clinical features, and outcomes of AKI in tropics, AKI in special reference to malaria, and the factors influencing the outcome of the AKI.

Materials and Methods: This is a retrospective clinical descriptive case study done between October 2009 and April 2012. 150 patients of acute renal failure admitted to Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar, were included in the study.

Results: A total number of 150 cases of ARF patients admitted to Mahatma Gandhi Memorial Hospital, Warangal, who met the inclusion criteria were studied.Of 150 patients, 102 were male and 48 were female, constituting 68% and 32%, respectively. Male-to-female ratio in this study is 2.125:1.

Conclusion: ARF is potentially a reversible condition. Mean age of presentation 50.54 years.Fever present in 70% and oliguria in 64.7% of cases. 76% of ARF cases recovered completely, 8% of cases partially recovered, and 16% of cases were not improved and dead.60.7% of cases were treated conservatively and 39.3%of cases required hemodialysis.

Key words: Acute, Kidney injury, Malaria

INTRODUCTION

Acute kidney injury (AKI) is characterized by a reversible decline in the glomerular filtration rate, leading to retention of nitrogenous waste products and an inability to maintain fluid and electrolyte homeostasis. The acute deterioration of renal function remains a common complication of many non-renal medical problems and therapies requiring hospital admissions (EPIDEMLOGY TREND CHANGES IN ARF–MMC).

It is one of the most enigmatic problems with reported incidence rates between 25% and 80% (Aki in tropics). The lack of a uniform definition, the paucity of multicentric, large studies, and underreporting in the tropics due to local conditions have created a void in the proper understanding of the epidemiology of AKI. The various incidence rates reported in literature from areas in the tropics are as follows: Kuwait (4.1 per year per million population), South Africa (20 per year per million population), Brazil (7.9 per 1000 admissions), and India (6.4 per 1000 admissions). The inability of a majority of the patients to make it to tertiary reporting centers remains one of the major reasons for the very low incidence rates when compared to those in temperate.

The etiology of AKI in tropics is different from that of temperate regions. Tropics – on geographical basis – refer to that part of the earth's surface which is between the tropics of cancer (23.5 south). The third world countries dominate this area predominately with a population diverse in racial and ethnic backgrounds. This area is unique in its warm and humid weather, large animal reservoir, and constantly changing dense microbiological environment.

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Together with widely prevalent malnutrition, poverty, and overcrowding, this region has unique diseases, infections, and plant/animal/microbial toxins which are common. Tropical nephrology includes both specific renal diseases detected in tropics but also seen in other parts of the world. Trauma, surgery, and sepsis contribute to majority of AKI cases in developed countries. In contrast, AKI in tropics occurs in younger age groups and usually follows infections and obstetric complications. Poor hygiene, warm climate, low socioeconomic status, widespread availability of over-the-counter drugs, and high incidence of infections such as malaria, dengue, and leptospirosis contribute to varied etiology seen in India. Dynamic trend changes mandate need for epidemiological studies to devise preventive and therapeutic strategies.

AKI is one of the most challenging problems faced by clinicians in the tropics due to its fast-changing burden. Underreporting, regional disparities and differences in definition and case mix are a barrier, limitation becomes even more critical during seasonal variations, for example, monsoon season in Southeast Asia (MOVING POINTS EPIDEMOLGY OF AKI). AKI in the tropics is strikingly different from that in the developed world in terms of etiology and presentation. In addition, there is a stark contrast between well-developed and poor areas in the tropics. The true epidemiological picture of AKI in the tropics is not well understood due to the late presentation of patients to tertiary centers.[1-8]

Aim of the Study
The aim of this study was as follows:
- To know the etiology, clinical features, and outcomes of AKI in tropics.
- To study AKI in special reference to malaria.
- To study the factors influencing the outcome of the AKI.

This is a retrospective clinical descriptive case study done between October 2009 and April 2012. 150 patients of acute renal failure (ARF) admitted to Mahatma Gandhi Memorial Hospital, Warangal, were included in the study.

MATERIALS AND METHODS

This is a retrospective clinical descriptive case study done between October 2009 and April 2012. 150 patients of ARF admitted to Mahatma Gandhi Memorial Hospital, Warangal, were included in the study.

Case Selection
Clinical diagnosis of ARF was considered when an abrupt increases in serum creatinine and blood urea, with or without a decrease in urine output in a person with previously normal renal function.

Inclusion Criteria
All in patients with clinical and of biochemical evidence of ARF.

That is, patients who satisfy any one of the following criteria were included in the study:
1) Patients with ARF clinically diagnosed when serum creatinine increases to more than 2 mg/100 ml with or without oliguria.
2) Patients with steady increase in serum creatinine concentration of at least 1 mg/100 ml over 48 h.
3) Patients with an increase in serum creatinine by more than 20% per day if the baseline is more than 2.5 mg/100 ml.

Exclusion Criteria
The following criteria were included in the study:
1) Age below 15 years.
2) Known case of chronic kidney disease.
3) Known case of diabetes mellitus, hypertension, amyloidosis, multiple myeloma.
4) Systemic vasculitis.
5) Acute on chronic renal disease.
6) Patients with previous renal transplantation.
7) Patients with evidence of contracted kidneys on ultrasound scan of abdomen.

All the patients were followed up till the time of discharge or death.

Detailed history and clinical profile of the patients were recorded.

Investigations
1) Serum creatinine.
2) Blood urea.
3) Serum electrolytes (sodium and potassium).
4) Complete hemogram.
5) Complete urine examination.
6) Ultra sound abdomen.
7) X-ray chest.
8) Peripheral smear for malarial parasite.
9) Blood for leptospiral antibody, dengue antibody.
10) Liver function test (serum bilirubin, serum glutamic-oxaloacetic transaminase, serum glutamic pyruvic transferase, alkaline phosphatase, serum total protein, and serum albumin).
11) Blood culture and sensitivity.
12) Arterial blood gas analysis.

Serum creatinine, blood urea, and serum electrolytes were done daily and recorded.

Treatment

All these patients were give adequate fluid management based on severity of dehydration as the first step in management. Daily input and output charts maintained. Treatment for the cause is done with antimalarials for malaria, antibiotics for acute GE, and septicemia cases.

Dialysis is done in patients with serum creatinine more than 8 mg/dl, hyperkalemia, uremia, and metabolic acidosis.

Clinical and laboratory parameters were analyzed to assess the possible etiology of ARF and the role of these parameters in the possible outcome, i.e., recovery or death.

The data were analyzed using Statistical Package for the Social Sciences software version 17.0; descriptive results are expressed as mean and SD of various parameters.

RESULTS AND OBSERVATIONS

A total number of 150 cases of ARF patients admitted to Mahatma Gandhi Memorial Hospital, Warangal, who met the inclusion criteria were studied.

Table 1: Gender distribution

Gender	n (%)
Male	102 (68.0)
Female	48 (32.0)
Total	150 (100.0)

Table 2: Age distribution

Age	n (%)
<20	3 (2.0)
21-30	21 (14.0)
31-40	16 (10.7)
41-50	41 (27.3)
51-60	33 (22.0)
61-70	23 (15.3)
71-80	11 (7.3)
>80	2 (1.3)

Table 3: Diagnosis number and percentage

Diagnosis	n (%)
Ac. GE	48 (32.0)
Sepsis	37 (24.7)
Leptospirosis	5 (3.3)
Dengue	8 (5.3)
Malaria	34 (22.7)
Snake envenomation	1 (7)
Hepatorenal syndrome	3 (2.0)
Surgical	3 (2.0)
Poisoning	1 (7)
Bee sting	1 (7)
OBG	1 (7)
Others	8 (5.3)
Total	150 (100.0)

Table 4: Outcomes number and percentage

Outcome	n (%)
Death	24 (16.0)
Partial recover	12 (8.0)
Recovered	114 (76.0)
Total	150 (100.0)

Table 5: Dialysis number and percentage

Dialysis	n (%)
Yes	59 (39.3)
No	91 (60.7)
Total	150 (100.0)

Table 6: Diagnosis and outcome

Diagnosis	Outcome (%)			
	Death	Partial recovered	Recovered	Total
Ac. GE	2 (4.2)	1 (2.1)	45 (93.8)	48 (100.0)
Sepsis	9 (24.3)	3 (8.1)	25 (67.6)	37 (100.0)
Leptospirosis	0 (0.0)	1 (20.0)	4 (80.0)	5 (100.0)
Dengue	0 (0.0)	1 (12.5)	7 (87.5)	8 (100.0)
Malaria	10 (29.4)	5 (14.7)	19 (55.9)	34 (100.0)
Snake envenomation	0 (0.0)	0 (0.0)	1 (100)	1 (100.0)
Hepatorenal syndrome	1 (33.3)	0 (0.0)	2 (66.7)	3 (100.0)
Surgical	1 (33.3)	0 (0.0)	2 (66.7)	3 (100.0)
Poisoning	1 (100.0)	0 (0.0)	0 (0.0)	1 (100.0)
Bee sting	0 (0.0)	0 (0.0)	1 (100.0)	1 (100.0)
Obstetric	0 (0.0)	0 (0.0)	1 (100.0)	1 (100.0)
Others	0 (0.0)	1 (12.5)	7 (87.5)	8 (100.0)

Table 7: Treatment modality

Treatment modality	n (%)
Hemodialysis	59 (39.3)
Conservative	91 (60.7)

Table 8: Age group with outcomes

Age	Outcome (%)			
	Death	Pre-recover	Recovered	Total
<20	1 (33.3)	0 (0.0)	2 (66.7)	3 (100.0)
21-30	4 (19.0)	2 (9.5)	15 (71.4)	21 (100.0)
31-40	5 (31.2)	0 (0.0)	11 (68.8)	16 (100.0)
41-50	4 (9.8)	1 (2.4)	36 (87.8)	41 (100.0)
51-60	4 (12.1)	6 (18.2)	23 (69.7)	33 (100.0)
61-70	2 (8.7)	2 (8.7)	19 (82.6)	23 (100.0)
71-80	4 (36.4)	1 (9.1)	6 (54.5)	11 (100.0)
>80	0 (0.0)	0 (0.0)	2 (100.0)	2 (100.0)

Of 150 patients, 102 were male and 48 were female, constituting 68% and 32%, respectively. Male-to-female ratio in this study is 2.125:1[Table 1].

About 24.7% of patients with ARF were between 20 and 40 years, 49.3% between 40 and 60 years, and 23.9% above 60 years. Mean age of incidence was 50.54 years [Table 2].

Of 150 cases studied, acute gastroenteritis cases accounted for 32% (48), followed by sepsis 24.7% (37), malaria 22.7% (34), dengue 5.3% (8), leptospirosis 3.3% (5), hepatorenal syndrome 2% (3), surgical 2% (3), snake envenomation, poisoning, bee sting, and obstetrical causes accounting to 0.7% each. Other miscellaneous causes such as CVA, MI, and COPD were 5.3% (8) [Table 3].

Of 150 patients studied, 76% (114) are recovered, 8% (12) partially recovered, and 16% (24) died [Table 4].

Of 150 cases, 39.3% (59) underwent hemodialysis and rest 60.7% (91) were treated conservatively [Table 5].

Acute GE is the major cause with 48 cases. 2 died, 1 partially recovered, and 45 recovered. Sepsis cases were 37, of which death is 9, partially recovered 3, and recovered 25. Leptospirosis cases were 5, of which 1 partially recovered and 4 recovered. Dengue cases were 8, of which 1 partially recovered and 7 recovered. Malaria cases were 34, of which 10 died, 5 partially recovered, and 19 recovered.

Hepatorenal syndrome and surgical cases were 3 each, 33.3% of deaths, 0.0% of partial recovery, and 66.7% of recovered patient are present. Snake envenomation, poisoning, bee sting, and obstetric cases were one each. Poisoning which is of super vasmol had 100% death as outcome. Snake envenomation, bee sting, and obstetric case had 100% recovery. Other cases including CVA, MI, and COPD are 8 and they had no death, partially recovered are 12.5% and recovered are 87.5% [Table 6].

Of the 150 cases studied, (39.3%) 91 patients are treated conservatively and (60.7%) 59 patients were treated with hemodialysis [Table 7].

In our study, of 150 cases of AKI with ages 15–80 years: Age <20 years 1 death, no partial recovered, and 2 recovered cases are present. 21–30 years 4 death, 2 partial recovered, and 21 recovered cases are observed. 31–40 years 5 death and 11 recovered. 41–50 years 4 death, 1 partial recovery, and 36 recovered. 51–60 years 4 death, 6 partial recovered, and 23 recovered. 61–70 years 2 death, 2 partial recovered, and 19 recovered. 71–80 years 4 death, 1 partial recovered, and 6 death. >80 years 2 recovered [Table 8].

Table 9: Oliguria and outcome

Oliguria	Outcome (%)			
	Death	Partial recovered	Recovered	Total
Present	11 (11.3)	5 (5.2)	81 (83.5)	97 (100.0)
Absent	13 (24.5)	7 (13.2)	33 (62.3)	53 (100.0)

Table 10: Anuria outcome

Anuria	Outcome (%)		
	Death	Partial recovered	Recovered
Present	11 (35.5)	6 (19.4)	14 (45.2)
Absent	13 (10.9)	6 (5.0)	100 (84.0)

Table 11: Jaundice outcome

Jaundice	Outcome (%)		
	Death	Partial recovered	Recovered
Present	13 (39.4)	4 (12.1)	16 (48.5)
Absent	11 (9.4)	8 (6.8)	98 (83.8)

Table 12: Hypoglycemia outcome

Hypoglycemia	Outcome (%)		
	Death	Partial recovered	Recovered
Present	7 (41.2)	3 (17.6)	7 (41.2)
Absent	17 (12.8)	9 (6.8)	107 (80.5)

Table 13: Alt.sens outcome

Alt.sens	Outcome (%)		
	Death	Partial recovered	Recovered
Present	17 (30.4)	8 (14.3)	31 (55.4)
Absent	7 (7.4)	4 (4.3)	83 (88.3)

Table 14: Potassium outcome

Potassium	Outcome (%)		
	Death	Partial recovered	Recovered
Present	15 (12.2)	11 (8.9)	97 (78.9)
Absent	9 (33.3)	1 (3.7)	17 (63.0)

Table 15: Treatment modality outcome

Treatment modality	Outcome (%)		
	Death	Partial recovered	Recovered
Present	10 (16.9)	11 (18.6)	38 (68.4)
Absent	14 (15.4)	1 (1.1)	76 (83.5)

Among 97 patients who had oliguria there are 11 deaths, 5 partially recovered and 81 recovered. According to pearson chi-square test P value is highly significant, $P < 0.014$ [Table 9].

Among 31 patients who had anuria, there are 11 deaths, 6 partially recovered, and 14 recovered. According to Pearson Chi-square test, *P* value is highly statistically significant, *P* < 0.001 [Table 10].

Among 33 patients who had jaundice, there are 13 deaths, 4 partially recovered, and 16 recovered. According to Pearson Chi-square test, *P* value is highly statistically significant, *P* < 0.001 [Table 11].

Among 17 patients who had hypoglycemia, there are 7 deaths, 3 partially recovered, and 7 recovered. According to Pearson Chi-square test, *P* value is highly statistically significant, *P* < 0.002 [Table 12].

Among 56 patients who had hypoglycemia, there are 17 deaths, 8 partially recovered, and 31 recovered. According to Pearson Chi-square test, *P* value is highly statistically significant, *P* < 0.001 [Table 13].

Among 123 patients with potassium <5.5 meq/l, there are 15 deaths, 11 partially recovered, and 97 recovered. Patient with potassium >5.5 meq/l is 27. Of which, there are 9 deaths, 1 partial recovered, and 17 recovered. According to Pearson Chi-square test, *P* value is <0.022 and is statistically significant [Table 14].

Of 150 patients studied, 91 patients treated conservatively and 59 patients required dialysis; among them, 10 died, 11 partially recovered, and 38 recovered. Pearson Chi-square test showed highly statistically significant value of <0.001 [Table 15].[9-17]

CONCLUSION

- ARF is potentially a reversible condition. Mean age of presentation 50.54 years.
- Medical causes accounted for 97% of cases with acute GE, sepsis, and severe malaria were the leading causes of ARF.
- Fever present in 70% and oliguria in 64.7% of cases.
- 76% of ARF cases recovered completely, 8% of cases partially recovered, and 16% of cases were not improved and dead.
- 60.7% of cases were treated conservatively and 39.3% of cases required hemodialysis.
- Severe derangement of parameters at admission and during the course of ARF had significantly high mortality rate.

SUMMARY

The present study is a prospective clinical study which included one 50 cases of ARF admitted to Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar.

- Mean age of incidence of ARF is 50.54 years, with male-to-female ratio of 2.125:1.
- The study showed various etiological factors associated with ARF such as acute gastroenteritis, sepsis, malaria, leptospirosis, dengue, snakebite, and hepatorenal syndrome.
- Medical causes accounted for 97% followed by surgical causes 2% and least due to obstetric causes 1%.
- Among medical causes acute GE accounted for 32% followed by sepsis 24.7%, malaria 22.7%, leptospirosis and dengue 8.6%, poisoning, snake poisoning and bee sting 2.1% and the other causes accounted for 5.3%.
- Common symptoms were fever, oliguria altered sensorium, diarrhea, and vomiting.
- Of 150 cases, 114 (76%) patients completely recovered, 12 (8%) partially recovered, and 24 (16%) patients not improved and dead.
- Patients presenting with altered sensorium, jaundice, anuria, and hypoglycemia had high mortality rates.
- Patients with malaria, sepsis, and complications, and patients requiring ventilatory support and hemodialysis had poor outcome.
- Severe derangement of parameters at admission and during the course of ARF had significantly high mortality rate.

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