

Study of Factors Affecting the Outcome in Acute Kidney Injury (AKI)

Chiluka Kiran

Assistant Professor, Department of General Medicine, Kakatiya Medical College, Mahatma Gandhi Memorial Hospital, Warangal, Telangana, India

Abstract

Background: Acute kidney injury (AKI) continues to be associated with high mortality despite the significant improvement in medical care. Factors other than renal functions probably determine the outcome, and their identification is necessary to improve the prognosis.

Materials and Methods: This is a prospective clinical descriptive study done between March 2018 and April 2019. Fifty patients admitted to Mahatma Gandhi Memorial Hospital, Warangal, with AKI were included in the study. Every patient will be evaluated by detailed history, clinical examination, and relevant investigations.

Results: Oliguria or anuria, fever, and altered sensorium were the most common presenting symptoms. Medical causes top first among the causes of AKI in 80% followed by surgical 16% and obstetric 4%. Among the medical causes, acute gastroenteritis with septicemia 34%, severe malaria 20%, and pneumonia with septicemia 10% is the predominant cause. Among surgical causes, sepsis following trauma was the leading cause. Among 50 cases, 15 (30%) completely improved, 12 (24%) cases only partially improved, and 23 (46%) cases not improved and dead. Surgical causes of AKI had 75% mortality rates. Patients presented with oliguria, altered sensorium, jaundice, or coma, and patients with high mean blood urea and serum creatinine at admission had high mortality rates. Patients with multiorgan dysfunction syndrome, hyperkalemia, septic shock, hypertension, ischemic heart diseases, and diabetes mellitus had significantly poor outcome.

Conclusion: Many factors other than AKI determine the outcome in AKI. Early and prompt diagnosis and treatment of primary disease-causing AKI with prevention and aggressive treatment of complications can improve the mortality.

Key words: Acute kidney injury, Factors, Outcome

INTRODUCTION

The kidney is remarkable among organs of the body in its ability to recover from almost complete loss of function, and most acute kidney injury (AKI) is potentially reversible, though with subclinical residual defects in tubules and glomerular functions.^[1] AKI is associated with major inpatient morbidity and mortality, reflecting the severity of the causal illness and the high frequency of complications.^[2,3]

AKI complicates nearly 5% of the hospital admissions and up to 30% of intensive care unit admissions.^[3] In most of the cases, it is potentially, reversible if recognized early and managed appropriately at a right time.^[4]

The etiology of AKI is closely linked to the prevailing socioeconomic and environmental conditions in a given geographic location. In India itself, there are differences in the etiology of AKI in different parts of the country. This is reflected as the difference in occurrence of etiology from studies conducted at different parts of the country.

There is a paucity of data from this area of the country about the incidence, clinical course, and the factors affecting the outcome in AKI.^[5,6] This study is being taken to study the clinical course, the outcome, and the factors affecting the outcome in AKI in our set up.

Access this article online



www.ijss-sn.com

Month of Submission : 10-2019
Month of Peer Review : 11-2019
Month of Acceptance : 12-2019
Month of Publishing : 12-2019

Corresponding Author: Dr. Chiluka Kiran, Department of General Medicine, Kakatiya Medical College, Mahatma Gandhi Memorial Hospital, Warangal, Telangana, India.

Aim of the Study

The aim of the study was as follows:

1. To study the clinical profile, course, and outcome of the patients presenting with AKI to Mahatma Gandhi Memorial Hospital, Warangal
2. To know the factors affecting the outcome in AKI presenting to our hospital.

MATERIALS AND METHODS

This is a prospective clinical descriptive study done between October 2005 and July 2007. Fifty patients of AKI admitted to Mahatma Gandhi Memorial Hospital, Warangal, were included in the study.

Case Selection

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

Inclusion Criteria

Patients who satisfy any one of the following criteria were included in the study.

1. Patients with AKI clinically diagnose when serum creatinine increases to more than 2 mg/100 ml with or without oliguria [Table 1]
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 [Table 2].

Exclusion Criteria

The following criteria were excluded from the study [Table 3]:

1. Patients aged <15 years
2. Patients with a history of severe chronic renal failure with usual serum creatinine concentration more than 3 mg/100 ml
3. Patients with previous renal transplantation
4. Patients with evidence of contracted kidneys on ultrasound scan abdomen.

Diagnostic Approach Followed

1. A detailed history and physical examination as per pro forma [Table 4]
2. Blood urea, serum creatinine, and serum electrolytes
3. Urine analysis
4. Complete hemogram, blood smear for malarial parasites [Table 5]
5. Blood for leptospiral antibody, dengue antibody, and rapid card test for malaria
6. Daily fluid intake output measurements
7. Ultrasound abdomen scan

8. Electrocardiography
9. If indicated, the following were done.
 - Urine for myoglobin, leptospira
 - Liver function test
 - Arterial blood gases analysis
 - Chest X-ray
 - Blood culture and sensitivity.

Patients were followed clinically and by serial biochemical tests and were started on conservative treatment, if indicated patients were taken for hemodialysis.

Statistical Methods

Chi-square test/ 2×2 , 2×3 , and 3×3 Fisher's exact test has been used to find the significant association of study characteristics with the outcome. About 90% confidence interval has been used to find the significance of study characteristics in the present study.

RESULTS AND OBSERVATION

Study Design

A prospective clinical descriptive study of 50 patients with AKI is undertaken to study the factors affecting the outcome.

About 34% of patients with AKI were between 20 and 40 years, 36% between 40 and 60 years, and 30% above 60 years. Mean age of incidence was 49.48 years.

Out of 50 patients, 35 were male and 15 were female, constituting 70% and 30%, respectively. Male and female ratio in this study is 2.33:1.

Among the various signs and symptoms at presentation, oliguria or anuria, fever, and altered sensorium were the most common followed by diarrhea, vomiting, and breathlessness. They can be either the features of the primary disease that caused AKI or the features of the complication of AKI.

Among the surgical causes of AKI, most patients presented with road traffic accidents, acute pain abdomen, vomiting, and fever.

Among the various comorbid conditions and risk factors studied in the present study, the most common is found to be due to multiorgan dysfunction followed by diabetes mellitus and ischemic heart disease.

The AKI cases with anuria, hyperkalemia, pulmonary edema, uremic encephalopathy, and multiorgan dysfunction were taken up for hemodialysis 24 (48%). The remaining 26 (52%) cases were treated conservatively and followed for improvement in renal functions.

Among 50 cases of AKI, 15 (30%) patients improved [Table 6], 12 (24%) patients only partially improved, and 23 (46%) patients not improved and died.

In the present study of AKI, patients who improved had prolonged hospital stay [Table 7]. Partially improved patients were started on maintenance hemodialysis and got discharged early with short hospital stay. Patients who did not improve and died early due to complications of AKI or of the primary disease so had shorter duration of hospital stay.

DISCUSSION

The observations made in 50 cases of AKI admitted to Mahatma Gandhi Memorial Hospital, Warangal. The study was done between March 2018 and April 2019.

The results are compared with other studies.

Age and Sex

In the present study, age of the patients ranged between 20 and 80 years with mean age of 49.48 years. There were

Table 1: Age distribution

Age in years	Number	Percentage
20–30	10	20.0
31–40	7	14.0
41–50	12	24.0
51–60	6	12.0
61–70	10	20.0
>70	5	10.0
Total	50	100.0
Mean±standard deviation	49.48±17.58	

Table 2: Gender distribution

Gender	Number	Percentage
Male	35	70.0
Female	15	30.0
Total	50	100.0

Table 3: Presentation of signs and symptoms

Signs and symptoms	Number (n=50)	Percentage
Fever	26	52.0
Oliguria	20	40.0
Altered sensorium	19	38.0
Diarrhea	17	34.0
Vomiting	16	32.0
Breathlessness	16	32.0
Abdominal pain	11	22.0
Edema	10	20.0
Anuria	10	20.0
Cough	9	18.0
Jaundice	9	18.0
Coma	3	6.0

70% of males and 30% of females, with male-to-female ratio 2.33:1 [Table 8]. In the present study, the mean age was less compared to other studies.

They are comparable with other studies, as shown in the tabular column below.

Symptoms and Signs of AKI

The study of common presenting symptoms and signs was made. We noted that oliguria and anuria, fever, and altered sensorium were the most common symptoms, followed by diarrhea, vomiting, and breathlessness.

The variations in the presenting symptoms and signs compared to other studies could be due to differences in causes and varying degrees of complications in different studies [Table 9].

Causes of AKI

In the present study, out of 50 cases of AKI medical causes topped the list comprising 80%, surgical causes 16%, and only 4% due to obstetric causes.

Among the medical causes, acute gastroenteritis (GE) 17 cases was the most common followed by severe malaria and pneumonia with septicemia [Table 10].

In the study by Sirwal *et al.* in the “Profile of AKI in Kashmir valley” which had 78.6% of cases due to medical causes, the leading cause was that due to acute GE accounting for 26.2% of cases compared to 34% in the present study.

Ramachandran in “AKI in Sri Lanka from Colombo,” medical causes accounted for 74% of cases, of which the leading cause was that of snakebite.

In Kaufman *et al.* study in “Community-acquired AKI from Boston,” among medical causes, acute GE was the leading cause in 25% of cases.

Table 4: Comorbid conditions of patients studied

Comorbid conditions	Number (n=50)	Percentage
Absent	27	54.0
Present	23	46.0
MODS	9	18.0
DM	7	14.0
IHD	4	8.0
HTN	2	4.0
CCF	1	2.0

Table 5: Treatment modalities for acute kidney injury

Treatment modalities	Number (n=50)	Percentage
Conservative	26	52.0
Hemodialysis	24	48.0

In the present study, severe malaria was the second most common cause of AKI accounting for 20% in that of falciparum malaria. This could be due to the endemicity of malaria in this area of study.

In the study by Singhal *et al.*, malaria was the predominant cause of AKI involving about 16% of cases with falciparum in 80% of patients.

In the study by Prakash *et al.*, 15% of patients had AKI due to malaria, with falciparum malaria responsible for 76%. These are comparable to the present study.

Table 6: Outcome in patients studied

Outcome	Number (n=50)	Percentage	90% Confidence interval
Improved	15	30.0	20.59–44.46
Partially improved	12	24.0	15.57–35.10
Not improved and death	23	46.0	34.91–57.50

Table 7: Association of the length of hospital stay with outcome

Outcome	Length of hospital stay	
	Range	Mean±standard deviation
Improved	4–31	11.67±8.79
Partially improved	1–21	12.00±5.43
Not improved and death	1–15	6.30±3.89
Significance	F=5.103, P=0.010*	

Significant Value is P=0.010

Table 8: Comparison with few other studies

Study series	Males in %	Females in %	Mean age group (years)
Present study	70	30	49.48
Bernieh <i>et al.</i>	58	36	56.2
Singhal <i>et al.</i>	63	34	53.5

Table 9: Comparative studies showing symptoms and signs

Symptoms and signs	Present study %	Bernieh <i>et al.</i> %	Singhal <i>et al.</i> %	Liano <i>et al.</i> %
Oliguria and anuria	60	78	80	80
Fever	52	-	68	-
Altered sensorium	38	-	-	-
Diarrhea	34	-	-	-
Vomiting	32	80	85.2	86
Breathlessness	32	-	-	-
Edema	20	20	-	-
Jaundice	18	-	20	-

Table 10: Findings with comparable to other studies

Major causes	Present study	Chug <i>et al.</i>	Muthu Sethapathi <i>et al.</i>	James Kaufman <i>et al.</i>	Sirwal <i>et al.</i>	Rama Chandran
Medical	80	61	81.2	83	78.6	74
Surgical	16	30	9.8	17	14.3	15
Obstetric	4	9	9	0	7	6

In the present study, septicemia due to various etiologies was responsible for AKI in 56% of total AKI cases. This is comparable to the study done by Bernieh *et al.*, who found septicemia causing AKI in 58% of cases.

Surgical cause of AKI found in 16% of patients in the present study, which is comparable to 9.8% of cases due to surgical AKI in Muthusethapathi *et al.* in their “Study AKI in Madras.”

In the present study, drug-induced nephropathy was seen in 2 (4%) of cases, which is comparable to the study by Bernieh *et al.*, who found drug-induced nephropathy in 6% of cases of AKI. Singhal *et al.* reported drug-induced AKI in 3% of patients.

In the present study, snakebite with cellulitis induced AKI in 2 (4%) of cases which is comparable to 4% of the Chug *et al.* study from Chandigarh.

Outcome and Factors Affecting Outcome

The outcome of AKI studied:

In the present study, out of 50 cases of AKI, 15 (30%) completely improved, 12 (24%) only partially improved, and 23 (46%) not improved and dead.

This is comparable to the study done by Mahakur *et al.* who had 44% of mortality in AKI.

This is in contrast to the study done by Mathur *et al.* who found that 71% of AKI cases recovered completely, 9% only partially improved, and 20% not improved and dead.

The course of stay in hospital and outcome of these patients with AKI is variable. In the present study, improved patients had longer duration of stay 4–31 days, compared to 1–15 days for dead. Duration of hospital stay is generally longer for hospital survivors.

Association of Symptoms and Outcome

In the present study, AKI patients who presented with altered sensorium, coma, jaundice, or oliguria had higher mortality. This is comparable to the study done by Chew *et al.* in their study of “Outcome in AKI.”

Causes of AKI with Outcome

In the present study, AKI due to various causes associates with septicemia and septic shock had high mortality. Out of 25 AKI cases due to sepsis-associated causes, 15 (60%) cases died. These finding are comparable to the study done by Nevu *et al.*, who found mortality of 74.5%.

In the present study, the mortality rate for severe malaria is 76% which is comparable to the study “Malaria in AKI” done by Mahaket *et al.* who found mortality in 44% of AKI cases due to malaria.

Among the surgical causes of AKI, mortality was seen in 75% of cases in the present study which is comparable to various outcome studies.

In the present study, out of 30 cases, oliguric and anuric AKI had an overall poor outcome with 9 (33%) cases partially improved and 16 (50%) patients not improved and dead. This is comparable to the study by Anderson *et al.* in “Non-oliguric AKI” who found the similar outcome, which is also comparable to a study done by Susan *et al.* in “Hospital-acquired renal insufficiency.”

In the present study, magnitude of the increase in serum creatinine levels showed a significant mortality which is comparable to the study done by Hou *et al.*, who found the similar outcome.

In the present study, the patients with comorbid conditions are 3 times more likely to have death compared to their absence. This also observed in the outcome study, done by Chew *et al.* in his study “outcome in AKI.”

The study done by Prakash *et al.* also showed that prognosis in AKI is grave when multiple comorbid conditions are present.

One case of HS syndrome following acute GE only partially improved and is on maintenance hemodialysis. This is comparable to the study done by Dedhia *et al.*

Treatment Modality on Outcome

In the present study, out of 50 cases of AKI, 26 (52%) cases were treated conservatively and 24 (48%) underwent hemodialysis. Patients treated conservatively significantly

improved with survival rates 67.5% than those treated with hemodialysis. Among 24 cases who underwent hemodialysis, 50 cases not and died. This may be due to the severity of AKI itself or due to its complications requiring hemodialysis. This is comparable to the study by Nevu *et al.*, who found that mortality was higher in dialyzed than non-dialyzed AKI cases. This is also comparable to Hakim *et al.*, in their study, about 58% of patients survived with conservative treatment of 48% of patients survived with hemodialysis.

The major risk factors affecting the prognosis were the severity of primary disease, the presence of multiorgan dysfunction, high baseline urea and creatinine levels, and other associated comorbid conditions.

CONCLUSION

- AKI is potentially a reversible condition
- Mean age of presentation 49 years
- Medical causes accounted for 80% of cases with acute GE, severe malaria and pneumonia were the leading causes of AKI
- Clinical features observed were almost comparable to studies conducted earlier
- Oliguria and anuria present in 60% of cases
- About 30% of AKI cases improved completely, 24% of cases partially improved, and 46% of cases were not improved and dead
- About 52% of cases were treated conservatively and 48% of cases required hemodialysis
- Factors such as septicemia, septic shock, surgical causes of AKI, presence of comorbid conditions, and complications were associated with adverse outcome.

REFERENCES

1. Brady HR, Brenner BM, Lieberthal W. Acute kidney injury. In: Brenner BM, Rector FC, editors. The Kidney. 7th ed., Vol. 1. Philadelphia, PA: Saunders Company; 1996. p. 1215-92.
2. Brady HR, Gary G, Singer GG. Acute kidney injury. Lancet 1995;346:1533-40.
3. Brady HR, Brenner BM. Acute kidney injury. In: Kasper DL, Braunwald E, Fauci AS, Hanser SL, Longo DL, Jameson JL, editors. Harrison's Principles of Internal Medicine. 16th ed., Vol. 2. New York: McGraw-Hill; 2005. p. 1504-13.
4. Miller TR, Anderson RJ, Linas SC, Henrich WL, Berns AS, Gabow PA, *et al.* Urinary diagnostic indices in acute kidney injury. Arch Internal Med 78;89:47-50.
5. Mahajan S, Tiwari S, Bharani R, Bhowmik D, Ravi S, Agarwal SK, *et al.* Spectrum of acute kidney injury and factors predicting the outcome in 94 intensive care units in India. Ren Fail 2006;28:119-24.
6. Kohli HS, Bhat A, Jairam A, Aravindan AN, Sud K, Jha V, *et al.* Predictions of mortality in acute kidney injury in a developing country a prospective study. Ren Fail 2007;29:463-9.

How to cite this article: Kiran C. Study of Factors Affecting the Outcome in Acute Kidney Injury (AKI). Int J Sci Stud 2019;7(9):76-80.

Source of Support: Nil, **Conflicts of Interest:** None declared.