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Original Research Article

CLINICAL PROFILE OF ACUTE KIDNEY INJURY IN ICU PATIENTS AT OSMANIA GENERAL HOSPITAL, HYDERABAD, TELANGANA

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Received : 06/03/2025
Received in revised form : 23/04/2025
Accepted : 15/05/2025

Keywords:
Acute Kidney Injury, Risk Factors, Renal Replacement Therapy, Mortality, Sepsis.

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DOI: 10.47009/jamp.2025.7.3.81

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2025; 7 (3); 422-427

ABSTRACT

Background: Acute Kidney Injury (AKI) is a common and serious condition encountered in Intensive Care Units (ICU), contributing to high morbidity and mortality rates. Its early recognition, appropriate management, and understanding of its clinical profile are crucial for improving patient outcomes. The aim is to determine the clinical profile and outcome of acute kidney injury in ICU patients. **Materials and Methods:** This prospective observational study was conducted on ICU patients diagnosed 100 patients with AKI at Osmania General Hospital between June 2022 and May 2024. Data were collected on demographics, clinical presentations, comorbidities, laboratory investigations, and management strategies. **Result:** A total of 100 ICU patients were included in the study, out of which 30% were diagnosed with AKI. The mean age of patients with AKI was 58.2 years, with a male predominance (60%). The most common risk factors identified were sepsis (40%), hypotension (35%), and diabetes mellitus (30%). The majority of AKI cases were classified as Stage 1 (60%), followed by Stage 2 (25%) and Stage 3 (15%). **Conclusion:** AKI is a prevalent and significant complication among ICU patients at Osmania General Hospital, with sepsis, hypotension, and diabetes being the leading risk factors. Early recognition, timely intervention, and proper management of underlying causes are essential to improving patient outcomes. Further studies are needed to establish protocols for the prevention and management of AKI in ICU settings.

INTRODUCTION

Globally approximately 13,000,000 individuals are affected by acute kidney injury (AKI) each year, leading to 1.7 million fatalities1. AKI is diagnosed in at least 20% of cases.[1,2]

The proportion of hospitalised patients and severely ill patients ranges from 30% to 60%. Acute kidney injury is the leading cause of organ failure in hospital intensive care units (ICUs), with even a mild level of AKI being linked to a 50% increased risk of mortality. Acute kidney injury imposes a significant societal burden in terms of the utilisation of health resources during the acute phase, as well as potential long-term consequences such as chronic kidney disease (CKD) and kidney failure. Approximately 80% of AKI cases occur in underdeveloped countries.[3]

The possible variations in AKI risk between higher and lower income countries can be attributed to a range of factors, including geographical, etiological, cultural, and economic considerations. The risk of acute kidney injury (AKI) in developing countries differs between urban and rural settings, depending on factors such as season, cultural norms, and the distribution of infectious pathogens. The impact of transportation and healthcare services, such as drugs, supplies, trained workers, and dialysis facilities, on the severity of acute kidney injury (AKI) and its prognosis varies.[4]

The International Society of Nephrology has urged nephrology and the broader healthcare community to collaborate to design effective measures to reduce the number of avoidable fatalities caused by untreated acute kidney injury (AKI) in poor nations.[5]

As there is only limited information on the epidemiology and outcomes of acute kidney injury (AKI) in critically ill patients from low- and middle-income countries. This study aims to identify the aetiology, short-term outcomes, and determinants of mortality in patients with AKI admitted to multiple medical and surgical Intensive Care Units (ICU's) in a tertiary care centre.

Aim of the Study

1. To assess of the clinical spectrum of AKI patients in ICU.
2. Identify the cause, risk and prognostic factors for AKI.
3. To assess of the outcome of the patients with AKI.

MATERIALS AND METHODS

This was a prospective observational study conducted at Osmania General Hospital, Hyderabad, Telangana, from June 2022 and May 2024. The study included 100 adult patients (age > 18 years) admitted to the ICU between June 2022 and May 2024, who were diagnosed with AKI. Diagnosis of AKI was made according to the Kidney Disease: Improving Global Outcomes (KDIGO) criteria, based on changes in serum creatinine levels and urine output.

Inclusion Criteria

1. Patients Age >18 and admitted in ICU.
2. An absolute increase in serum creatinine of more than or equal to 0.3mg/dl (>26.4umol/L)
3. A percentage increase of serum creatinine of more than equal to 50% or Urine output

Exclusion Criteria

1. Patients with previous history of CKD; USG abdomen showing bilateral contracted kidney.
2. Presence or suspicion of renal obstruction
3. Chronic Kidney Disease (CKD) or End-Stage Renal Disease (ESRD): Patients with a known diagnosis of CKD in stages 4 or 5, or those already undergoing renal replacement therapy (RRT) for ESRD.
4. Pre-existing Renal Replacement Therapy: Patients who were receiving chronic dialysis or had been on dialysis prior to ICU admission.
5. Patients who died within 24 hours of ICU Admission: Those who were not observed for a sufficient duration to evaluate kidney function and outcomes.

RESULTS

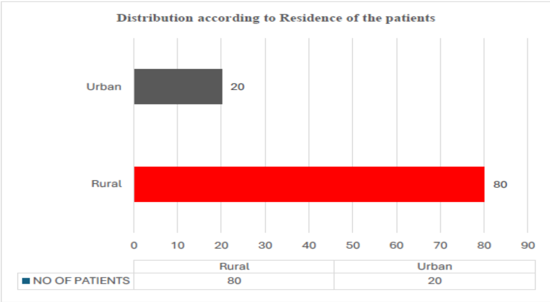

Figure 1: Distribution according to residence type

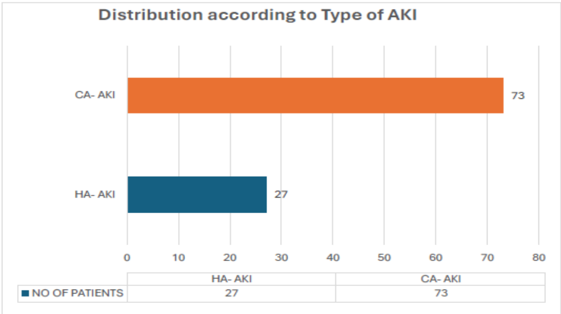

Figure 2: Representation of type of AKI

Table 1: Age Wise Distribution

S.No	Age in years	No. of patients	Percentage
1	18-40	13	13
2	40-60	68	68
3	>60	19	19
	Total	100	100

Table 2: Distribution according to causes of AKI (N=100).

S. No	Causes	No. of Patients	Percentage
1	Acute Gastroenteritis	28	28
2	Infective causes	26	26
3	Hepatic causes	14	14
4	Cardiac causes	21	21
5	Poisoning	5	5
6	Snake bite	5	5
7	Others	1	1
	Total	100	100

Table 3: Distribution According to stage of AKI

S.No	Stages	No. of patients	Percentage
1	Stage I	21	21
2	Stage II	45	45
3	Stage III	34	34
	Total	100	100

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Table 4: Distribution According to Urine Output Status

S.No	Urine Output Status	No. of patients	Percentage
1	Anuric	7	7
2	Oliguric	39	39
3	Non oliguric	54	54
	Total	100	100

Table 5: Co-Morbidities in the study population (N=100)

S. No	Co morbidities	No. of patients	Percentage
1	Diabetes Mellitus only	16	16
2	Chronic liver disease	14	14
3	Hypertension only	13	13
4	Heart failure only	12	12
5	Hypertension and Diabetes	12	12
6	Hypertension and Heart Failure	11	11
7	Hypertension, Diabetes and Heart failure	2	2
8	No co-morbidities	20	20

Table 6: Distribution According to Systemic Complication

S. No	Complications	No. of Patients
1	Metabolic acidosis	32
2	Fluid overload	42
3	Encephalopathy	30
4	Hyperkalaemia	21

Table 7: Distribution of Study subjects based on outcomes

Outcome	Number of patients (n)
Mortality	40
Partial recovery on medical management	8
Partial recovery RRT dependent	2
Complete Recovery	50

Table 8: Characteristics of Survivor's Versum Non-Survivors

S. No	Parameter	Survivors (60)	Non Survivors (40)	P Value
1	Age	47 + 10.67	54.88 + 14.4	< 0.01
2	Male Gender	34 (56%)	26 (65%)	0.37
3	Peak Creatinine	3.95 + 1.2	4.86 + 1.45	< 0.01
4	pH	7.33 + 0.16	7.23 + 0.24	0.02
5	Serum Potassium	4.54 + 0.68	4.74 + 0.77	0.17
6	Mechanical ventilation	12 (20%)	28 (70%)	< 0.01
7	Vasopressor use	35 (58%)	26 (65%)	0.48
8	RRT Need	31 (51%)	28 (70%)	0.06

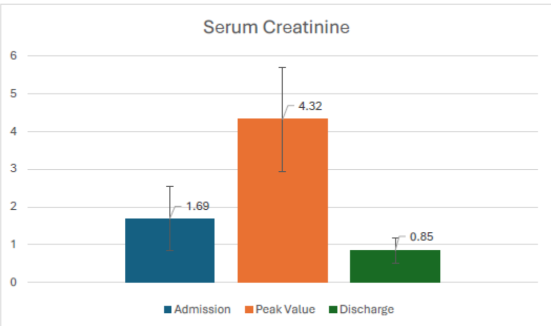

Figure 3: Comparison of Serum Creatinine at Admission, Peak value and Discharge

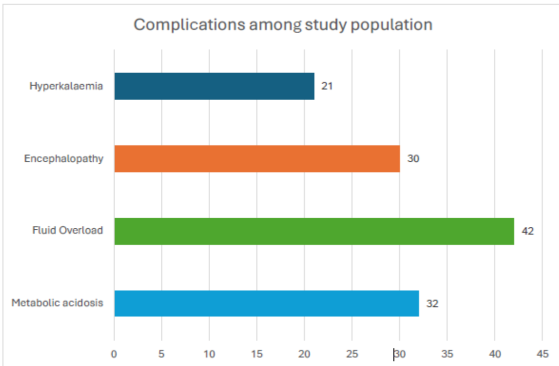

Figure 4: Complications among Study Population

DISCUSSION

In our prospective study investigating the clinical profile and outcome of acute kidney injury (AKI) patients in the ICU, we examined the age-wise distribution of our study cohort to better understand the demographic characteristics of individuals affected by AKI.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

The age-wise distribution of patients indicates that most AKI patients in the study are aged 40-60 years (68%), with the least number of patients being in the 18-40 years age group (13%). This suggests a higher incidence or prevalence of AKI in the 40-60 years age group within our sampled population. The mean age of patients is 50.2±12.8.

According to study by Pillai et al,[6] 45.7% of AKI patients were aged 40-60 years. According to study by Prasad et al,[7] mean age of patients was 44.7±16.5.

Hence results of our study align with the above-mentioned studies. This shows a significant burden of AKI in middle-aged and older adults. This could be due to various factors such as comorbidities, severity of illness, and exposure to nephrotoxic agents, which are more common in these age groups.

The distribution according to residence type revealed that 80% of the total sample resided in rural areas, while 20% resided in urban areas. This distribution highlights a significant majority of patients originating from rural settings within the sampled population.

The data reveals a diverse range of etiologies contributing to AKI, highlighting the multifactorial nature of this condition in critically ill patients.

Acute gastroenteritis emerges as the leading cause of AKI, accounting for 28% of cases. This high prevalence underscores the significant impact of severe dehydration and electrolyte imbalances associated with gastroenteritis on renal function.

Cardiac causes, including heart failure and myocardial infarction, account for 21% of AKI cases. The association between cardiac dysfunction and renal impairment, known as cardiorenal syndrome, underscores the need for integrated management approaches targeting both cardiac and renal health in these patients. Poisoning and snake bites each contribute to 5% of AKI cases.

Mehta et al,[8] (2015) and Kellum et al,[9] (2017) have both reported that infections, gastrointestinal diseases, and cardiovascular conditions are common precipitating factors for AKI. These findings underscore the need for comprehensive management strategies that address the diverse underlying causes of AKI.

The distribution according to the type of AKI revealed that 27% of the total sample experienced Hospital-Acquired AKI (HA-AKI), while 73% experienced Community-Acquired AKI (CA-AKI). This distribution highlights a higher prevalence of CA-AKI within the sampled population compared to HA-AKI.

The observed distribution of AKI types in our study cohort may have important implications for patient care, management strategies, and outcomes. Patients with HA-AKI may have a higher burden of comorbidities and be more susceptible to complications due to their underlying medical conditions and prolonged exposure to healthcare environments.

On the other hand, CA-AKI is often precipitated by conditions such as sepsis, volume depletion, nephrotoxic drug exposures outside of the hospital setting, and other community-acquired infections.

The higher prevalence of CA-AKI observed in our study cohort may be due to cases being recruited from medical ICU only.

Comparative studies, such as those by Luyckx et al,[10] (2017), have shown that rural populations often face higher risks of AKI due to limited health care resources, delayed medical intervention, and higher exposure to nephrotoxic substances. Addressing these disparities requires concerted efforts to improve healthcare infrastructure, education, and access in rural areas to prevent and manage AKI effectively.

The distribution according to the stages of AKI revealed that 21% of the total sample experienced Stage I AKI, 45% experienced Stage II AKI, and 34% experienced Stage III AKI. This distribution highlights a significant proportion of patients experiencing Stage II AKI, followed by Stage III and Stage I.[11]

Stage II AKI may indicate a moderate impairment in kidney function, requiring close monitoring and early intervention to prevent progression to more severe stages and mitigate associated complications. Stage III AKI, being the most severe form, necessitates prompt and aggressive management to prevent irreversible kidney damage and improve patient outcomes.

Similar studies, such as the one by Hoste et al,[12] have demonstrated that higher stages of AKI are associated with increased morbidity and mortality. Early identification and appropriate management of patients in the early stages of AKI could potentially improve outcomes and reduce progression to more severe stages.

The distribution according to urine output status among patients with AKI revealed that 7% of the total sample were anuric, 39% were oliguric, and 54% were Non-oliguric. This distribution highlights a significant proportion of patients with non-oliguric AKI, followed by oliguric and anuric cases.

Non-oliguric AKI, characterized by normal or increased urine output, constituted the majority of cases in our study cohort, comprising 54% of patients. This finding suggests that a substantial number of AKI patients present without the classic hallmark of decreased urine output. Non-oliguric AKI can present challenges in early detection and diagnosis, as patients may not exhibit overt signs of kidney injury based on urine output alone.

Oliguric AKI, characterized by decreased urine output, represented 39% of cases in our study cohort. Oliguria is often considered a marker of severe renal impairment and is associated with a higher risk of complications and adverse outcomes.

Studies by Mehta et al. (2015) have highlighted that non-oliguric AKI can be as severe as oliguric or anuric AKI and requires equally aggressive management. Accurate assessment of kidney function through biomarkers and imaging, in addition to urine output, is essential for effective diagnosis and treatment.

Diabetes Mellitus: The most prevalent co-morbidity in our study is diabetes mellitus, affecting 16% of the patients. This aligns with existing literature that identifies diabetes as a major risk factor for AKI due to its association with microvascular complications and increased susceptibility to infections.

Chronic liver disease is the second most common co-morbidity, present in 14% of the patients. The high prevalence of CLD among AKI patients can be attributed to the complex interplay between liver dysfunction and renal impairment, often referred to as hepatorenal syndrome.

Hypertension alone is observed in 13% of the patients. Hypertension is a well-known risk factor for kidney damage, leading to conditions such as hypertensive nephropathy, which can predispose patients to AKI.

Heart failure alone is present in 12% of the patients. The relationship between heart failure and AKI, often termed cardiorenal syndrome, highlights the bidirectional nature of these conditions, where heart failure can lead to renal hypoperfusion and subsequent AKI.

A comparison of serum creatinine levels at three critical points: admission, peak value during the ICU stay, and discharge.

The mean serum creatinine level at admission was 1.69 ± 0.86 mg/dL. This elevated level indicates that many patients were already experiencing some degree of renal impairment upon ICU admission. Elevated creatinine at admission is often associated with pre-existing kidney conditions or acute insults such as sepsis, dehydration, or exposure to nephrotoxic agents.

By discharge, the mean serum creatinine level had decreased to 0.85 ± 0.33 mg/dL in the 60 patients who were discharged. This reduction indicates a significant recovery of renal function in these patients.

The progression from admission to peak and then to discharge creatinine levels highlights the dynamic nature of AKI in ICU patients. The initial high levels at admission and peak values underscore the need for early identification and aggressive management of AKI to prevent further renal damage.

The mortality rate in our study is 40%, indicating a significant burden of AKI in critically ill patients. This high mortality rate underscores the severity of AKI and the need for early identification and aggressive management to improve survival rates. Factors contributing to mortality may include the severity of the underlying illness, delayed diagnosis, and inadequate response to treatment.

Only 2 patients experienced partial recovery but remained dependent on renal replacement therapy (RRT). This small number indicates that while RRT can be life-saving, it may not always lead to full renal recovery. These patients require long-term dialysis support and careful management to maintain their quality of life.

Encouragingly, 50 patients achieved complete recovery, representing 50% of the study population. This outcome demonstrates that with appropriate and timely interventions, a significant proportion of AKI patients can fully recover renal function. Factors contributing to complete recovery may include early diagnosis, effective management of underlying causes, and supportive therapies.

The significant differences in age, peak creatinine, pH, and the need for mechanical ventilation between survivors and non-survivors highlight critical factors that influence outcomes in AKI patients. Advanced age, severe renal impairment, acidosis, and respiratory failure are key predictors of mortality.

These findings emphasize the importance of early identification and aggressive management of these risk factors to improve survival rates in AKI patients.

CONCLUSION

This study provides a comprehensive analysis of acute kidney injury (AKI) in ICU patients, focusing on demographic characteristics, causes, biochemical parameters, systemic complications, and outcomes.

The leading causes of AKI in this study are acute gastroenteritis (28%) and infective causes (26%), followed by cardiac causes (21%) and hepatic causes (14%). Less common causes include poisoning and snake bites (5% each). This distribution underscores the importance of addressing infectious diseases and gastrointestinal conditions to prevent AKI, especially in rural settings.

Biochemical Parameters: The comparison of serum creatinine levels at admission, peak value, and discharge provides insights into the progression and resolution of AKI. By discharge, the mean creatinine level decreases to 0.85 ± 0.33 mg/dL in 60 patients, reflecting substantial recovery in a subset of the population. The tendency towards hyperkalemia underscores the importance of regular monitoring of serum potassium levels and the use of interventions such as potassium-binding agents, dietary modifications, and, in severe cases, renal replacement therapy.

The state of acidosis necessitates careful assessment and management, which may include bicarbonate therapy or other measures to correct the acid-base imbalance.

Systemic Complications: These complications highlight the multifaceted challenges in managing AKI and the need for comprehensive monitoring and intervention strategies.

Outcomes: The outcomes of AKI patients in this study are varied. Mortality is observed in 40% of the patients, indicating a significant burden of AKI in critically ill individuals. Partial recovery with medical management is seen in 8 patients, while 2

ISSN (O): 2687-5365; ISSN (P): 2753-6556

patients remain RRT-dependent. Encouragingly, 50% of the patients achieve complete recovery, demonstrating the potential for renal function restoration with appropriate care.

Characteristics of Survivors Versus Non-Survivors: The comparison between survivors and non-survivors reveals significant differences in several parameters. Non-survivors are older (mean age 54.88 ± 14.4 years) compared to survivors (mean age 47 ± 10.67 years), and have higher peak creatinine levels (4.86 ± 1.45 mg/dL vs. 3.95 ± 1.2 mg/dL). Additionally, non-survivors exhibit lower pH levels (7.23 ± 0.24) and a higher need for mechanical ventilation (70% vs. 20%). These findings highlight the critical factors influencing mortality in AKI patients and underscore the importance of early and aggressive management.

In conclusion, our study provides valuable insights into the demographic, clinical, and outcome characteristics of AKI patients in the ICU. The findings underscore the multifactorial nature of AKI and the critical importance of comprehensive management strategies that address the diverse etiological factors, comorbidities, and systemic complications associated with this condition. Also providing timely renal support are crucial for reducing mortality and enhancing recovery in AKI patients. Further research and improved healthcare strategies are essential to address the challenges associated with AKI in critical care settings.

This study has several limitations. The relatively small sample size of 100 patients may limit the generalizability of the findings. Being a single-center study, the results might be influenced by specific practices and patient demographics at the study site. Additionally, the study focuses on in-hospital outcomes without long-term follow-up data, which limits understanding of chronic kidney disease progression and post-discharge quality of life. Excluding patients with pre-existing chronic kidney disease or those transferred to other facilities may have impacted the comprehensiveness of the study. Addressing these limitations in future research could provide a more comprehensive understanding of AKI in ICU patients and help develop more effective management strategies.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556