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Frequency of Acute Kidney Injury in Patients Admitted to the Medical Intensive Care Unit at KRL Hospital, Islamabad

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ABSTRACT

Objectives: To determine the frequency of acute kidney injury in patients admitted to the Medical Intensive Care Unit at a tertiary care hospital. **Study design:** Cross-sectional observational study. **Place and duration of study:** Department of Nephrology, KRL Hospital, Islamabad, from February 2025 to June 2025. **Methodology:** A total of 170 patients aged between 33 to 70 years admitted to the medical intensive care unit were enrolled in this study. Acute kidney injury was diagnosed using modified KDIGO criteria which was based on serum creatinine rise >0.3 mg/dL within 48 hours, >50% increase within 7 days, or urine output <0.5 mL/kg/hour for ≥6 consecutive hours. Data were further analyzed for classification of acute kidney injury and to find the associated factors in the development of this acute injury. **Results:** The mean age was 53.1 ± 9.98 years. Male patients were 57.6% of total study population while female patients were 42.4%. Acute kidney injury was diagnosed in 68 (40%) of cases. Among the diagnosed patients, 52.9% belonged to Stage I, 29.4% Stage II, and 17.6% Stage III of kidney injury. The increase in serum creatinine rise >0.3 mg/dL within 48 hours was the most common diagnostic criteria found in 42.6% of patients. Statistically significant associations were found between acute kidney injury and diabetes mellitus (47.1% vs 30.4%, p=0.03), hypertension (55.9% vs 36.3%, p=0.01), anemia (41.2% vs 21.6%, p=0.01), and prolonged MICU stay ≥5 days (33.8% vs 18.6%, p=0.02) while no significant associations were observed with dyslipidemia or obesity. **Conclusion:** Acute kidney injury occurs at a significant proportion of 2 out of 5 patients in the medical intensive care unit underscoring the importance of early identification of the incidence and to adopt strategies for improved patient outcomes.

INTRODUCTION

Acute kidney injury (AKI) is a heterogeneous, critical clinical syndrome that arises from diverse pathological insults and is identified by elevated serum creatinine (sCr) or reduced urine output, carrying serious immediate and long-term implications for patient outcomes. This syndrome ranges from mild, reversible biochemical abnormalities to complete renal failure that requires replacement therapy.[1,2] AKI is therefore associated with marked increase in morbidity and mortality, both during the acute phase and in the long term.[3]

AKI is common among indoor patients, particularly those admitted to intensive care unit (ICU). The epidemiological data show an incidence of 5-7% in overall hospitalized patients while this become notably high from 20-50% (depending upon various health care settings and facilities) in patients admitted to ICU.[4] The environment of Medical ICU (MICU) typically presents with complex medical conditions requiring intensive monitoring and aggressive therapeutic interventions and faces unique challenges for AKI prevention and management. This higher incidence is explained by multifactorial insults during their stay such as, hemodynamic instability, hypovolemia, and underlying comorbidities (such as diabetes mellitus (DM), hypertension (HTN), dyslipidemia, anemia, and obesity). Sepsis-induced inflammatory responses can directly compromise renal perfusion and cellular integrity. Additionally, concurrent therapeutic interventions, though life-saving, may contribute to renal injury through mechanisms such as drug-induced nephrotoxicity.[5,6,7]

Standard criteria like the KDIGO guidelines have improved the diagnosis of AKI and enabled the healthcare providers to make a precise identification, apply staging of AKI status and plan appropriate management. These criteria use sCr levels and oliguria to assess decline in renal function. This standardized definition also facilitates epidemiological research with better approximation of this life-threatening condition at various health care settings.[8]

Previous work on the incidence of AKI reveals considerable variation across different ICU populations and regions. Understanding the local epidemiology in

MICUs is therefore essential for targeted prevention, optimal resource allocation, and improved outcomes. Accurate and reliable data of AKI frequency may guide the administrators to plan staffing, equipment, and treatment protocols, enabling timely interventions, and supporting effective preventive and therapeutic strategies. Early recognition of high-risk patients and timely nephroprotective strategies also help to lessen the severity of the incidence.[9]

The prevalence of AKI among ICU patients remains under-reported in Pakistan. An alarmingly high frequency of 68.55% was reported in a study conducted at a tertiary care hospital, underscoring the magnitude of this disorder in our local health care settings.[10] However, these results can't be generalized due to variations in demographics and ICU practices. Moreover, earlier studies often lacked updated diagnostic standards, which may cause underestimation of milder cases. Locally generated data assessed on the basis of the gold standard KDIGO criteria are essential for accurate assessment and improved patient care in our MICUs.

The MICU at KRL Hospital, Islamabad, serves a large number of high-risk populations where the prevalence of AKI remains understudied. This study was planned to determine the frequency of AKI in patients admitted at MICU, KRL Hospital, Islamabad. These findings will help the clinicians in early detection and risk stratification, thereby optimizing the preventive strategies to ensure improved patient outcomes in MICUs.

METHODOLOGY

This cross-sectional observational study was conducted at the Department of Nephrology, KRL Hospital, Islamabad, from 15th of February 2025 to 15th of June 2025, following the approval from ethical review board of the hospital.

The sample size was calculated using WHO software, based on an expected frequency of AKI as 53.3%.[11] with a margin of error of 7.5% and a confidence level of 95%, the minimum required sample size (n) was 170 patients.

A total of 170 patients aged 20-70 years admitted to the MICU within the last 48 hours were included in this study through non-probability consecutive sampling.

Patients with pre-existing CKD requiring hemodialysis were excluded to focus specifically on AKI. Additionally, patients with prior renal transplant, or contrast-induced nephropathy at admission were also excluded.

Written informed consent was obtained from each patient/or the attendant prior to their enrolment in the study. Demographic information, medical history, and comorbid conditions were recorded for each patient at the time of their admission to MICU. Baseline sCr was measured within 24 hours of their admission, and urine output was then monitored every 2 hours using calibrated flasks. Patients follow up was ensured throughout their stay at MICU.

The Modified KDIGO criteria was used to define the AKI where the presence of any one of the following: a rise in sCr >0.3 mg/dL within 48 hours of admission, an increase in sCr >50% within 7 days from baseline, or urine output reduction to <0.5 mL/kg/hour for at least 6 consecutive hours, was taken and recorded as an incidence of AKI. The diagnosed cases of AKI were further staged as per KDIGO criteria based on the degree of rise in sCr and reduction in urine output. Stage I was defined by an increase in sCr of at least 0.3 mg/dL within 48 hours, or 1.5 to 1.9 times the baseline within seven days, or when the urine output was < 0.5 mL/kg/hour for 6 to 12 hours. Stage 2 corresponded to a rise in sCr to 2.0 to 2.9 times the baseline or when the urine output was < 0.5 mL/kg/hour for at least 12 hours. Stage 3 represented the most severe category, which was by an increase in sCr to 3 times the baseline, a value ≥4.0 mg/dL, initiation of renal replacement therapy, urine output < 0.3 mL/kg/hour for 24 hours, or anuria lasting 12 hours or more.[12]

A patient was defined as diabetic when there was a documented history with treatment for ≥6 months and HbA1c ≥7%. Similarly, patients were listed as hypertensive when there was a documented history with treatment for ≥6 months achieving SBP ≤130 mmHg and DBP ≤90 mmHg. Dyslipidemia was declared when the use of lipid-lowering therapy or meeting laboratory thresholds (total cholesterol ≥240 mg/dL, triglycerides ≥150 mg/dL, or HDL <40 mg/dL) was present in the patient.

Data were analyzed using SPSS version 25. Continuous variables (such as age, sCr, and duration of admission) were shared as mean ± standard deviation (SD) or median with interquartile range (IQR), depending on normality of data. Categorical variables (such as gender, comorbidities, and AKI status) were presented as frequencies and percentages. Stratification was performed to assess the association of AKI with respect co-morbidities including diabetes, hypertension, dyslipidemia, dyslipidemia, anemia, obesity, and duration of MICU admission to. Chi-square test was then applied, with a p-value ≤0.05 taken as statistically significant.

RESULTS

The mean age in this study was 53.1 ± 9.98 years (range 33–70 years). Males constituted 57.6% while females constituted 42.4% of total study population. The baseline demographics, clinical characteristics and details of co-morbidities are shared in Table 1.

Table 1

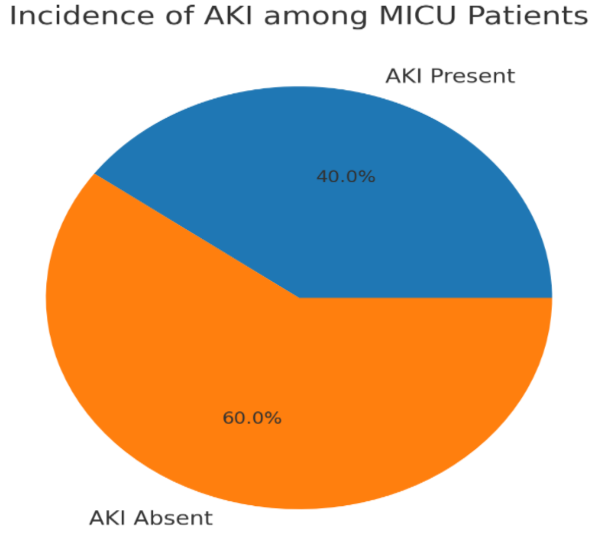
Baseline Demographics, Clinical Characteristics and Co-Morbidities (n=170)

Demographics		Value
Age (Mean± SD) Years		53.1 ± 9.98
Gender	Male n (%)	98 (57.6)
	Female n (%)	72 (42.4)
Clinical characteristics and co-morbidities		
Diabetes mellitus n (%)		64 (37.6)
Hypertension n (%)		80 (47.1)
Dyslipidemia n (%)		42 (24.7)
Obesity (BMI ≥30) n (%)		36 (21.2)
Anemia n (%)		50 (29.4)
Baseline sCr (Mean± SD) mg/dL		1.17±0.43
Duration of MICU stay (Mean± SD) days		8.03±3.68

Based on modified KDIGO criteria, AKI was diagnosed in 68 (40.0%) patients, while kidney functions remained normal in 102 (60%) patients as shown in Figure 1.

Figure 1

Incidence of AKI among Study Participants



Among the patients diagnosed with AKI majority of patients (52.9%) belonged to stage I followed by stage II (29.4%) and stage III (17.6%). Moreover, majority of patients met the criteria of "sCR creatinine rise >0.3 mg/dL within 48 hours", followed by other criteria as shown in Table 2.

Table 2

Stages of AKI (n=68)

Stages of AKI and criteria met for AKI diagnosis		
Stages of AKI	Stage I n (%)	36 (52.94)
	Stage II n (%)	20 (29.41)
	Stage III n (%)	12 (17.65)
KDIGO criteria met for AKI diagnosis	sCr rise >0.3 mg/dL within 48 hours n (%)	29 (42.65)
	sCr increase >50% within 7 days n (%)	16 (23.53)
	Urine output <0.5 mL/kg/hr for ≥6 hours n (%)	13 (19.12)
	≥ 2 criteria met n (%)	10 (14.71)

A significant association was observed between AKI and comorbid conditions like diabetes, hypertension, anemia and longer duration of MICU stay (≥ 5 days), whereas no statistically significant relationship was observed with the presence of dyslipidemia or obesity among MICU patients as shown in Table 3.

Table 3

Association of AKI with comorbid conditions (n = 170)

Comorbidities	Diagnosed with AKI (n=68)	No AKI (Normal kidney functions) (n=102)	p-value
Diabetes mellitus n (%)	32 (47.06)	31 (30.39)	0.03
Hypertension n (%)	38 (55.88)	37 (36.27)	0.01
Dyslipidemia n (%)	20 (29.41)	22 (21.57)	0.25
Obesity	18 (26.47)	20 (19.61)	0.29
Anemia	28 (41.18)	22 (21.57)	0.01
Duration of MICU stay ≥ 5 days n (%)	23 (33.82)	19 (18.63)	0.02

DISCUSSION

The results of our study showed AKI in 68 (40%) patients, which is consistent with international reports where MICU related incidence of AKI ranged from 20–50% in most of the studies. Among the diagnosed patients, 52.9% had Stage I, highlighting the potential for early recognition and prompt intervention to improve the outcomes. The sCr rise >0.3 mg/dL within 48 hours was the most common diagnostic criteria found in 42.6% of patients. Statistically significant associations were found between the development of AKI and DM (47.1% vs 30.4%, p=0.03), HTN (55.9% vs 36.3%, p=0.01), anemia (41.2% vs 21.6%, p=0.01), and prolonged MICU stay ≥5 days (33.8% vs 18.6%, p=0.02) while no significant associations were observed with dyslipidemia or obesity. These results highlight the significant burden of AKI among critically ill MICU patients in Pakistan, in line with the previously reported international, regional and local evidence.

Melo FAF et al. conducted a study of 1029 ICU patients in Brazil. A high AKI incidence of 53.3% was reported in this study with older age, nonsurgical status, high APACHE II scores, and fluid balance >1500 ml/24h being the prominent risk factors. It was a concerning finding that AKI doubled ICU mortality risk (aOR 2.03) in these patients.[11] Similar high rates of AKI have been reported in other developing countries, suggesting that this complication represents a global challenge in critical care settings. In a study conducted in Ethiopia, Ashine TM et al., retrospectively followed 317 ICU patients to the frequency of AKI incidence and its predictors. AKI occurred in 128 patients (40.4%), with independent predictors being mechanical ventilation, negative fluid balance, and hypertension.[13] Singh NP et al. aimed to evaluate the etiological profile and outcomes of AKI in 120 ICU patients in India. Similar to our finding, most of the patient belonged to Stage I (47.5%) followed by Stage II (27.5%), and Stage III (25%) respectively. It was noted that mortality was significantly high (28%), particularly in Stage III patients. Sepsis and anemia were common risk factors linked to poor prognosis.[14]

Pervaiz R et al. assessed AKI frequency, risk factors, and outcomes in the patients admitted to ICU in Pakistan. AKI occurred in 32.7% of patients, with stage 1 comprising the most (60.1%). Advanced age, hypertension, ACEI/ARB use, and higher APACHE II scores were significant risk factors associated with AKI, while age (HR 1.3) and APACHE II (HR 1.6) were independent predictors. The study emphasized the need for early risk factor management to avoid the development and progression of the incidence.[15] Similar findings were shared by Khan SA et al. in a study in hospitalized patients at Nishtar Hospital, Multan where 27.9% developed AKI. These cases were more prevalent in diabetics (46%) and hepatobiliary disorders (36.1%). Drug-induced AKI was most common (39.3%), followed by sepsis (19.6%) and in cases of volume loss (17.7%).[16] These Pakistani studies collectively demonstrate that AKI also remains a significant clinical challenge across the region, with consistent risk factor profiles across the population.

The increasing incidence of AKI in hospital admitted patients was recognized in a recent review article by Koh ES and Chung S. The review described the risk of CKD development in vulnerable post-AKI period, explores related biomarkers and pathophysiology and discussed future therapeutic challenges and opportunities of improving the outcomes.[17]

In a recently published study to examine AKI incidence and unrecognized rates in Chinese hospital base record collected over 13 years. The data showed that among 5,080 AKI patients, 76.3% were unrecognized. It is important that recognized AKI patients recovered faster than unrecognized cases ($p<0.001$) highlighting the critical need for enhanced detection protocols in hospitalized patients.[18] The alarming rate of unrecognized AKI highlighted in this large-scale study underscores a critical gap present in clinical practices across the globe.

The findings of our studies and the studies discussed above are aligned to the growing evidence of burden related to AKI in ICUs and validate the global relevance of AKI risk factors.

This also calls for the need of context-specific prevention by taking practical measures such as routine risk screening for diabetes, hypertension, and anemia at ICU admission, strict monitoring of sCr and urine output and early fluid management protocols in Pakistani healthcare settings.

Limitations of our study include its single-center design. Moreover, we did not follow the patients after discharge to assess the long-term renal outcomes which may have provided additional insights.

CONCLUSION

AKI represents a significantly observed complication of MICU patients. The complication is significantly associated with diabetes, hypertension, anemia, and prolonged ICU stay. These findings emphasize the importance of early detection and the implementation of nephroprotective measures to improve the outcomes. Strengthening the surveillance and applying the preventive strategies may help in minimizing the burden of AKI in our intensive care settings.

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