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Research Article

Incidence of Acute Kidney Injury (AKI) Using P- Rifle Criteria and Outcome in Patients with Aki at Picu, Jln Medical College, Ajmer

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ABSTRACT

Introduction: Acute Kidney Injury (AKI), previously termed acute renal failure, is a critical condition defined by a sudden decline in kidney function, resulting in the accumulation of nitrogenous waste, elevated serum creatinine and disrupted fluid, electrolyte and acid-base homeostasis. **Aim:** To find out the incidence of acute kidney injury (AKI) using P- RIFLE criteria and outcome in AKI patients in PICU. **Methodology:** The present study was conducted in the Department of Pediatrics at JLN Hospital, Ajmer. Ethical approval for the study was obtained from the Institutional Ethics and Review Committee and written informed consent was obtained from the parents or legal guardians of all participants before enrollment. This was a hospital-based prospective observational study conducted over a period of one year from January 2024 to December 2024. **Result:** The incidence of acute Kidney Injury (AKI) among PICU patients was 30%, with gastroenteritis due to dehydration and sepsis being the most common associated conditions. AKI was significantly associated with higher baseline serum creatinine, longer PICU stay and increased mortality, with outcomes worsening as the severity of AKI increased. **Conclusion:** Acute kidney injury is a common complication among critically ill children admitted to the PICU and is associated with increased mortality and prolonged PICU stay. Early identification using the p-RIFLE criteria and prompt management of modifiable risk factors, particularly dehydration and sepsis improve patient outcomes.

Keywords: Acute Kidney Injury, P- RIFLE Criteria, PICU

INTRODUCTION

Acute Kidney Injury (AKI), previously termed acute renal failure, is a critical condition defined by a sudden decline in kidney function, resulting in the accumulation of nitrogenous waste, elevated serum creatinine and disrupted fluid, electrolyte and acid-base homeostasis [1] .In pediatric patients, particularly those in pediatric intensive care units (PICUs), AKI poses a significant threat due to its high prevalence, association with increased morbidity and mortality and potential for long-term renal complications. Studies report that up to 30% of critically ill children develop AKI, with severe cases risking Multiple Organ Dysfunction Syndrome (MODS) or death if not addressed promptly. AKI acts as both a marker of disease severity and an independent predictor of poor outcomes, even after accounting for comorbidities [2,3]. In 2004, the Acute Dialysis Quality Initiative (ADQI) introduced the RIFLE criteria (Risk, Injury, Failure, Loss and End-stage kidney disease) for adults, stratifying AKI based on serum creatinine changes and urine output [1,4]. However, its dependence on baseline creatinine values, often unavailable in children, limited its pediatric utility. To overcome this, the pediatric-modified RIFLE (pRIFLE) criteria were developed, incorporating age-specific parameters like estimated creatinine clearance (eCCL) via the Schwartz formula and weight-adjusted urine output. A prospective study of 150 critically ill children using p-RIFLE identified AKI in 82% of cases, often within the first week of PICU admission, highlighting its value for early detection [5]. The Assessment of Worldwide AKI, Renal Angina and Epidemiology (AWARE) study, involving 4,683 children, reported a 26.9% AKI incidence in critically ill pediatric patients, with 11.6% progressing to severe stages [6]. AKI is more prevalent in males (56.4%) and shows a bimodal age distribution, peaking in children aged 1–5 years and adolescents aged 15–18 years, who often require ICU care. Clinically, AKI presentation varies by etiology: oliguric AKI, caused by hypoxic/ischemic insults, hemolytic uremic syndrome, or acute

glomerulonephritis, is defined by urine output less than 0.5-1 mL/kg/hour in infants or 0.5 ml/kg/hr in older children and carries worse outcomes [7]. Nonoliguric AKI, often due to nephrotoxic drugs like aminoglycosides or contrastinduced nephropathy, has a better prognosis. Prognostic tools like the Pediatric Risk of Mortality (PRISM) and Pediatric Index of Mortality II (PIM II) scores, which include renal parameters, aid in risk stratification and guide PICU management [8]. Given the high burden of AKI, its severe consequences and persistent diagnostic and epidemiological challenges, prospective studies are essential to enhance early recognition, optimize treatment and generate context-specific data [9], particularly in understudied settings. This observational prospective study aims to determine the incidence of AKI in critically ill children admitted to the PICU using p-RIFLE criteria and to evaluate clinical outcomes, including mortality and PICU stay duration. By addressing these objectives in a specific PICU setting, the study seeks to contribute to the global understanding of pediatric AKI, inform early intervention strategies and mitigate the impact of AKI in resource-limited environments, ultimately improving patient outcomes in pediatric critical care.

Aim

To find out the incidence of acute kidney injury (AKI) using P- RIFLE criteria and outcome in AKI patients in PICU.

METHODS

The present study was conducted in the Department of Pediatrics at JLN Hospital, Ajmer. Ethical approval for the study was obtained from the Institutional Ethics and Review Committee and written informed consent was obtained from the parents or legal guardians of all participants before enrollment. This was a hospital-based prospective observational study conducted over a period of one year from January 2024 to December 2024. Children aged more than 28 days up to 18 years who were admitted to the Pediatric Intensive Care Unit (PICU) during the study period were included. Patients who were diagnosed with clinical brain death at the time of admission or within six hours of admission to the PICU, as well as those whose parents or guardians did not provide consent for participation, were excluded from the study.

RESULTS

In the present study the mean age of AKI patients was 5.2±3.1 that is slightly lower to non AKI patients age that is 6.1 ±3.4, age of patients has no significant difference. (p = 0.12) In our study the Male and female ratio was 1.5 : 1 in KI patients that is equal to non AKI patients where Male : female ratio was 13:1 (p-value 0.65) The mean weight of AKI patients was 20.5±8.2 kg and patients without AKI had slightly high weight 22±9.0 kg (p-value = 0.23) (Table 1).

In the present study Diarrhea and vomiting were the most common diagnoses in the AKI group, accounting for 44.44% of AKI cases, compared to 23.81% in the non-AKI group. Sepsis was also a frequent diagnosis, observed in 20% of AKI patients and 19.05% of non-AKI patients. And other diagnosis: respiratory failure, diabetic ketoacidosis, nephrotic syndrome, snake bite, burns, trauma, post-surgical conditions and miscellaneous causes were less frequently observed in both groups. A statistically significant difference was found in the pattern of admission diagnoses between AKI and non-AKI groups (p = 0.03) (Table 2).

In the present study the baseline serum creatinine (SCr) level 0.6±0.2 in the AKI group were found to be significantly higher in comparison to the non-AKI group which was 0.5 ± 0.2 mg/dL. This difference was statistically significant, with a p-value of 0.01, indicating a meaningful association between higher baseline creatinine levels and the development of AKI (Table 3).

Table 1: Age of PICU Patients by AKI Status

Parameters		AKI	Non AKI	p-value
Age (Years), Mean ±SD		5.2±3.1	6.1±3.4	0.12
Gender	MALE n(%)	54 (60 %)	120 (57%)	0.65
	FEMALE n (%)	36 (40%)	90 (43%)	
WEIGHT (KG)MEAN±SD		20.5±8.2	22±9.0	0.23

Table 2: Diagnosis at admission of PICU Patients by AKI Status

Admission Diagnosis	Parameters	A	KI
	N	-	%
Diarrhea/ vomiting	40	-	44.44
Sepsis	18	-	20
RESPIRATORY FAILURE	5	-	5.56
Diabetic ketoacidosis	5	-	5.56
Nephrotic syndrome	5	-	5.56
Snake bite	3	-	3.33
Burn	1	-	1.11
TRAUMA	1	-	1.11
Post-Surgical	2	-	2.22
OTHERS	10	-	11.11
p-value		-	0.03

Table 3: Baseline Serum Creatinine of PICU Patients by AKI Status

Parameters	AKI	Non AKI	p-value
BASELINE SCr.(mg/dl), MEAN±SD	0.6±0.2	0.5±0.2	0.01

Table 4: Incidence of AKI by p-RIFLE Stage

Parameters	N	Percentage (95% CI)
Total PICU ADMISSION	300	100%
NO AKI	210	70% (64.7-75.3%)
AKI ANY STAGE	90	30%(24.7-35.3%)

Table 5: p-RIFLE Stage of AKI Patients in PICU

p-RIFLE Stage	N	Percentage (95% CI)
RISK	50	55.56% (45.24–65.88%)
INJURY	25	27.78% (18.62–36.94%)
FAILURE	15	16.67% (9.01–24.33%)

Table 6: Outcome by AKI Status and p-RIFLE Stage

	No AKI (n = 210)	AKI (n = 90)	p-value	Risk (n = 50)	Injury (n = 25)	Failure (n = 15)	p-value (Across stages)
PICU Mortality n (%)	10 (4.76%)	14 (15.56%)	0.01	3 (6%)	4 (16%)	7 (46.67%)	0.03

Table 7: Length of Stay (LOS) in PICU by AKI Status and p-RIFLE Stage

Parameters	No AKI (n = 210)	AKI (n = 90)	p-value	Risk (n = 50)	Injury (n = 25)	Failure (n = 15)	p-value (Across stages)
PICU LOS (days) median (IQR)	4 (2-6)	8 (5-12)	<0.001	7 (49)	8 (513)	10 (615)	<0.001

Table 8: Dehydration (Diarrhea/Vomiting) in PICU Patients by AKI Status

Dehydration	AKI (n = 90)	Non AKI (n = 210)	p -value
Yes	40 (44.44%)	50 (23.81%)	<0.001
NO	50 (46.66%)	195 (.7619 %)	

In a present study out of a total of 300 pediatric admissions to the Intensive Care Unit (PICU), 90 children (30%) were diagnosed with acute kidney injury (AKI), based on the p-RIFLE criteria. The remaining 210 patients (70%) did not develop AKI during their PICU stay. The 95% confidence interval (CI) for the incidence of AKI was 24.7% to 35.3%, while for non-AKI it was 64.7% to 75.3% (Table 4).

In present study the distribution of p-RIFLE stages among 90 PICU patients with acute kidney injury (AKI), The Risk stage was the most common, affecting 50 patients (55.56%, 95% CI: 45.24–65.88%), followed by the Injury stage with 25 patients (27.78%, 95% CI: 18.62–36.94%) and the Failure stage with 15 patients (16.67%, 95% CI: 9.01–24.33%) (Table 5).

In present study the mortality rate was significantly higher in the AKI group (14 deaths, 15.56%) compared to the non-AKI group (10 deaths, 4.76%), with a p-value of 0.01 indicating a statistically significant difference (Table 6).

The median LOS for non-AKI patients (n = 210) was 4 days (IQR 2–6), while for AKI patients (n = 90), it was significantly longer at 8 days (IQR 5–12), with a p-value of <0.001 indicating a statistically significant difference. Among AKI patients, LOS varied by p-RIFLE stage: The Risk stage (n = 50) had a median LOS of 7 days (IQR 4–10), the Injury stage (n = 25) had a median LOS of 8 days (IQR 5–12) and the Failure stage (n = 15) had the longest median LOS of 10 days (IQR 6–15) (Table 7).

In the present study Dehydration was significantly more common in PICU patients with AKI (44.44%) compared to those without AKI (23.81%), with a p-value <0.001, indicating a strong association between dehydration and AKI (Table 8).

DISCUSSION

This observational prospective study was conducted to determine the Incidence of Acute Kidney Injury (AKI) in patients admitted to the PICU at JLN Medical College, Ajmer, using the p-RIFLE criteria. The study also aimed to assess associated outcomes, including mortality and PICU length of stay.

The overall incidence of AKI in our study was 30%, which falls within the range reported by previous studies such as the AWARE study, which reported an incidence of 26.9% in critically ill children and the study by Akcan-Arikan *et al*. [10], reported AKI in 82% of PICU patients using p-RIFLE criteria. The lower incidence in our study may be due to timely arrival, timely fluid management and quality of care in our PICU.

In our study, diarrhea and vomiting (Gastroenteritis) (44.44%) were the most common diagnoses associated with AKI, followed by sepsis (20%). These findings are consistent with previous studies by Lameire NH *et al*. [11] and Cerdá J *et al*. [12], indicating that pre-renal causes such as dehydration are the predominant triggers of AKI in resource-constrained settings.

In our study gender distribution showed a slight male predominance in AKI patients (60%), which is in line with findings from Sutherland *et al*. [13] (55%) and the AWARE study [14] (56.4%), which also observed a higher incidence of AKI among male children. Age and weight did not show a significant association with AKI (p = 0.12 and p = 0.23, respectively).

In our study the baseline serum creatinine levels were significantly higher in AKI patients (0.6±0.2 mg/dL) compared to non-AKI patients (0.5±0.2 mg/dL) (p = 0.01). These findings are similar to Alkandari *et al*. [15] (0.9±0.4 mg/ dl) who observed that elevated initial SCr, even within the normal range, is associated with increased AKI risk. This underscores the utility of baseline SCr monitoring in predicting renal outcomes.

Regarding p-RIFLE staging, the majority of AKI patients fell into the 'Risk' stage (55.56%), followed by 'Injury' (27.78%) and 'Failure' (16.67%). This stage-wise distribution is similar to the data from Akcan-Arikan *et al*. and Hoste *et al*. [16], indicating that early-stage AKI remains most common in PICU populations [9,10]. The progressive decline in frequency from Risk to Failure reflects early recognition and possible intervention at earlier stages.

In our study the mortality rate among AKI patients was significantly higher (15.56%) than non-AKI patients (4.76%) (p = 0.01), which is consistent with earlier findings that AKI is an independent predictor of mortality in critically ill pediatric populations. The increasing mortality across AKI stages-6% in Risk, 16% in Injury and 46.67% in Failure (p = 0.03) demonstrates a dose-dependent impact of AKI severity on outcomes, as highlighted in studies by Hoste *et al*. [9] and Hussain *et al*. [17].

Length of stay (LOS) was significantly longer in AKI patients [median 8 (512) days] than in non-AKI patients [median 4 (2-6) days] (p<0.001). These were similar to study done by Maqbool *et al*. [18] demonstrated that AKI is associated with prolonged ICU admissions due to complications and delayed recovery. Dehydration was significantly more common among AKI patients (44.44%) than in non-AKI patients (23.81%) (p<0.001), indicating its strong predictive value in the development of AKI. This finding is corroborated by Lameire *et al*. [11] and Prowle *et al*. who emphasized volume replacement as a key modifiable risk factor for AKI.

CONCLUSIONS

This study showed that acute kidney injury (AKI) is a common complication among critically ill children admitted to the PICU. According to the p-RIFLE criteria it has an incidence of 30%. Gastroenteritis with dehydration and sepsis were the most common conditions associated with AKI. Our study showed the importance of early recognition and management of preventable risk factors. AKI was significantly associated with higher baseline serum creatinine, prolonged PICU stay and increased mortality, with mortality rising progressively according to the severity of p-RIFLE staging. AKI is an predictor of adverse outcomes in critically ill children. Early identification of high-risk patients, their monitoring of renal function, adequate fluid management and timely interventions are essential to reduce the complications of AKI and improve clinical outcomes in the pediatric intensive care

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