Original Research

ACUTE KIDNEY INJURY AND ITS SEVERITY IN SICK PEDIATRIC PATIENTS: A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Acute kidney injury (AKI) is a frequent and clinically significant complication in critically ill pediatric patients, associated with increased morbidity, prolonged intensive-care stay, and adverse outcomes. Despite its high incidence, early identification remains challenging owing to the inherent limitations of conventional diagnostic markers.

Objectives:To determine the incidence of AKI and its severity among sick children admitted to a tertiary care Pediatric Intensive Care Unit (PICU).

Methods: This prospective observational study was conducted over 18 months at Government Children's Hospital, Bemina, Srinagar. Seventy-five children aged 1 month to 18 years admitted to the PICU for a minimum of 48 hours were enrolled. Serum creatinine, urine output, and fluid balance were assessed at baseline, 12 hours , Day3, and Day7. AKI was classified using Kidney Disease: Improving Global Outcomes (KDIGO) criteria.

Results: Severe AKI was observed in 42.67% of the study population, with 37.33% and 26.67% of patients meeting criteria on Day 3 and Day 7 respectively. Serum creatinine rose progressively from a mean baseline of 0.49 ± 0.14 mg/dL to 1.37 ± 1.34 mg/dL by Day 3. Renal replacement therapy (RRT) was required in 24.00% of patients. Overall mortality at 28 days was 33.33%.

Patients with severe AKI exhibited significantly higher creatinine levels, lower urine output, and greater clinical injury scores (all $p < 0.001$).

Conclusions: More than 40% of critically ill pediatric patients are affected by AKI, and is associated with significant disease severity and mortality.

Keywords: Acute Kidney Injury; Creatinine, Pediatric Intensive Care Unit.

INTRODUCTION

Acute kidney injury (AKI) represents one of the most consequential complications of pediatric critical illness, characterised by an abrupt decline in renal function with resultant accumulation of metabolic waste products and disruption of fluid, electrolyte, and acid-base homeostasis.

AKI occurs in approximately 5% of all hospitalized pediatric patients, with the incidence rising dramatically to nearly 30% in those admitted to PICUs.

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The Assessment of Worldwide Acute Kidney Injury, Renal Angina, and Epidemiology (AWARE) study [3]reported an incidence of 26.9% using standardised KDIGO criteria across 32 international PICUs, while another study Assessment of Worldwide Acute Kidney Injury Epidemiology in Neonates (AWAKEN) study [4,12] identified AKI in 29.9% of neonates, particularly among extremely preterm infants.

The aetiology of AKI in children is diverse and age-dependent. In neonates, hypoxic-ischaemic injury, sepsis, and congenital anomalies of the kidney and urinary tract predominate [4,12]. In older children, AKI is more commonly precipitated by sepsis, haemolytic uraemia syndrome, acute gastroenteritis with dehydration, and nephrotoxic drug exposure. Regardless of aetiology, sepsis-associated AKI

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carries the highest mortality risk and is the most common trigger of AKI in PICU settings globally [3,5,6]. The present study was designed to prospectively determine the incidence and severity of AKI among critically ill pediatric patients admitted to a tertiary care PICU.

METHODS

This was a prospective observational study conducted in the Pediatric Intensive Care Unit (PICU) of the Department of Pediatrics, in collaboration with the Department of Pediatric Nephrology, at Government Children's Hospital, Bemina, an associated hospital of Government Medical College, Srinagar. The study was conducted over a period of 18 months from July 2024 to January 2026, following approval from the Institutional Ethics Committee.

Study Population and Sample Size

The study population comprised pediatric patients admitted to the PICU during the study period. All children aged between 1 month and 18 years who required intensive care and had a PICU stay of at least 48 hours were considered eligible. Patients were enrolled consecutively after satisfying the inclusion and exclusion criteria and following written informed consent from parents or legal guardians. A total of 75 patients meeting eligibility criteria were included in the final analysis.

Inclusion and Exclusion Criteria

Patients aged 1 month to 18 years admitted to the PICU for a minimum of 48 hours were included. Patients were excluded if they were younger than 1 month of age, had chronic kidney disease with an estimated glomerular filtration rate (eGFR) below 15 mL/min/1.73 m², had undergone any surgery within the preceding 30 days, or were discharged or expired within 48 hours of PICU admission.

Data Collection

A standardised clinical assessment was performed at admission and throughout the PICU stay. Data collected included demographic information (age and sex), anthropometric measurements, primary diagnosis, comorbid conditions, illness severity assessed by the Pediatric Index of Mortality-2 (PIM-2) score, exposure to nephrotoxic medications, fluid intake and urine output, requirement for mechanical ventilation and vasopressor or inotropic support, and PICU and hospital length of stay.

Laboratory Assessment and Renal Function Estimation

Serum creatinine was measured at admission (baseline), 12 hours, Day 3, and Day 7. Estimated glomerular filtration rate (eGFR) was calculated using the modified Schwartz formula: eGFR = 0.413 × (height in cm / serum creatinine in mg/dL). Percentage fluid overload was calculated as: [(total fluid intake−total fluid output)×100] / weight at PICU admission (kg).

AKI definition and staging was applied as per Kidney Disease: Improving Global Outcomes (KDIGO) 2012 criteria [2,10].

RESULTS

Seventy-five children were enrolled over the 18-month study period. The study population had a mean age of 5.31 ±5.17 years (range: 0.20–16.00 years). Toddlers aged 1.1–4 years formed the largest age group (36.00%), followed by infants ≤1 year (25.33%), children aged 4.1–11 years (20.00%), and adolescents aged 11.1–18 years (18.67%), indicating a predominance of younger children. Gender distribution was nearly equal, with females constituting 50.67% and males 49.33% of the cohort. Mean body weight was 19.53 ±14.71 kg, mean height was 98.79 ±34.75 cm, and mean BMI was 17.22 ±3.80 kg/m². The majority had normal nutritional status (90.67%). Comorbid conditions were present in 44.00% of patients. Exposure to nephrotoxic drugs was documented in 13.33% of participants.

Illness Severity and Clinical Interventions

Most patients presented with moderate illness severity based on PIM-2 scoring (45.33% moderate, 32.00% low, 22.67% high). A significant proportion required intensive supportive interventions: mechanical ventilation in 57.33%, inotropic support in 60.00%, and haemodynamic instability was recorded in 81.33% of patients. None of the enrolled patients had a history of solid organ transplantation. The mean arterial pressure at admission was 59.21 ± 8.41 mmHg, and the mean clinical injury score was 3.60 ± 2.49, reflecting variability in early renal injury across the study cohort.

Renal Function Parameters

Progressive renal dysfunction was documented across time points. Mean baseline serum creatinine was 0.49 ± 0.14 mg/dL. This increased to 0.89 ± 1.15 mg/dL at 12 hours, and further to 1.37 ± 1.34 mg/dL by Day 3. The mean lowest recorded urine output was 0.88 ± 0.38 mL/kg/ hour. Fluid balance assessment revealed a mean net positive balance of 436.93 ± 250.99 mL over the first 12 hours, corresponding to 29.26 ± 18.74 mL/kg.

Table 1. Serial Renal Function Parameters

Parameter	Mean ± SD	Range
Baseline serum creatinine (mg/dL)	0.49 ± 0.14	0.30–0.90
Serum creatinine at 12 hours (mg/dL)	0.89 ± 1.15	0.30–9.80
Serum creatinine at Day 3 (mg/dL)	1.37 ± 1.34	0.30–6.74
Lowest urine output (mL/kg/hour)	0.88 ± 0.38	0.10–2.00

Net fluid balance (mL/kg) at12 hours	29.26 ± 18.74	7.69–131.25

Table 2. Incidence and Severity of Acute Kidney Injury

Outcome	n	Percentage (%)
Severe AKI (overall)	32	42.67
Severe AKI on Day 3	28	37.33
Severe AKI on Day 7	20	26.67
Renal replacement therapy required	18	24.00

Comparaison of Parameters between Patients with and Without Severe AKI

DISCUSSION

The overall incidence of severe AKI was 42.67%, with 37.33% and 26.67%, on Day 3 and Day 7 respectively. These findings are consistent with large multicenter data. The AWARE study [3], reported an AKI incidence of 26.9% in critically ill children globally, while institution-based studies from South Asia and other resource-limited settings have reported incidences ranging from 30% to 70%, partly reflecting differences in patient mix, diagnostic criteria, and baseline risk profiles.

The predominance of younger children in our cohort—with 61.33% below 4 years of age— is consistent with reported literature, underscoring the heightened vulnerability of this age group to critical illness-associated organ dysfunction. The nearly equal gender distribution, with a marginal female predominance (50.67%), is in contrast to the slight male preponderance noted in some multicenter pooled data but is in agreement with individual single-centre studies from comparable settings[11,13,14]

The progressive rise in serum creatinine from a mean baseline of 0.49mg/dL to 0.89mg/dL at 12 hours and 1.37 mg/dL by Day 3, accompanied by declining urine output, underscores the rapid and dynamic evolution of renal dysfunction in PICU-admitted children. This temporal pattern of creatinine escalation highlights the narrow diagnostic window available for early intervention—a window that is frequently missed when AKI detection is deferred to conventional creatinine-based thresholds [6,7].

The high prevalence of haemodynamic instability (81.33%), inotrope use (60.00%), and mechanical ventilation (57.33%) in our cohort aligns with published data [3,9] from similarly constituted ICU populations. These interventions are recognised independent contributors to renal hypo-perfusion andAKI.

Patients with severe AKI demonstrated significantly worse renal parameters compared to those without, with markedly elevated 12-hour and Day 3 creatinine levels and reduced urine output (all $p < 0.001$). Notably, fluid balance did not differ significantly between AKI and non-AKI groups ($p=0.232$), a finding echoed in prior studies [7,9] that highlight the limited discriminatory power of fluid overload as an isolated predictor ofAKI.

This study has several limitations. The single-centre design and relatively small sample size may limit the generalisability of findings. The heterogeneity of underlying diagnoses may have introduced confounding.

CONCLUSION

Acute kidney injury is highly prevalent among critically ill pediatric patients, affecting more than two in five children admitted to the PICU in this cohort. AKI is associated with significant disease severity, and are at higher risk for need of RRT requirement.

Conflict of Interest: The authors declare no conflict of interest.

Funding: This study received no external funding.

Ethical Approval: Ethical clearance was obtained from the Institutional Ethics Committee of Government Medical College, Srinagar. Written informed consent was obtained from parents or legal guardians of all participants.

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