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A prospective, observational study to determine the outcome of patients with acute kidney injury in pediatric intensive care unit

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Abstract
Background: The Spectrum and burden of AKI in developing countries may be different from that of developed countries**.**
Objective: to determine the short-term clinical outcome in children with Acute kidney injury admitted in PICU.
Setting: PICU (Pediatric Intensive Care Unit) at Basaveshwar teaching and general hospital and Sangameshwar hospital attached to Mahadevappa Rampure medical college.
Result: most common condition associated with AK was sepsis, encephalitis. Pre-renal causes accounted for (54) 78.3% of AKI. In the present study, AKI Stage 1, 2, 3 was diagnosed in 11 (15.9%), 14 (20.3%) and 44(63.8%) of AKI patients. Maximum number of AKI patients were in Stage 3 ($p<$ 0.001). 63.8%. AKI was associated with increased mortality ($p<0.000$).mortality rate was 34.8% compared to non AKI.
Conclusion: It was concluded AKI continues to be associated with adverse outcomes, including high mortality and morbidity. Early diagnosis of AKI using new defined criteria (AKIN, RIFLE, p RIFLE) along with early and appropriate management of risk factors will prevent the progression of AKI and decrease the mortality and morbidity of AKI patients.

Keywords: Pre-renal, mortality rate, outcome, acute kidney injury

Introduction
Mortality rates in critically ill children with AKI are high, ranging between 9% and 67% and increase if complicated by multiorgan failure, organ transplantation and acute respiratory distress syndrome. Most cases of incident AKI represent acute tubular necrosis (ATN) that is secondary to hypovolemia, sepsis or the use of nephrotoxic agents. Acute kidney injury (AKI) is an important condition in hospitalized patients, associated with adverse short-and long term outcomes [1].
AKI is defined as rapid deterioration of renal function resulting in retention of nitrogenous wastes and inability of kidney to regulate fluid and electrolyte homeostasis. In the past, a lack of objective diagnostic criteria has resulted in wide variability of definitions that have been used for this condition [2].
The definition and staging of AKI has been recently standardized using the RIFLE classification proposed by the Acute Dialysis Quality Initiative Group], and the one suggested by the Acute Kidney Injury Network (AKIN). These classifications have been examined in hospitalized adults and children, and found useful in characterizing AKI.
The Spectrum and burden of AKI in developing countries may be different from that of developed countries [3].
Detection of outcome of AKI is important for commencement of preventive and therapeutic strategies [4].
The present study is conducted to determine the short-term clinical outcome in children admitted in PICU (Basaweshwar teaching and general hospital and Sangameshwar hospital Kalaburagi with Acute kidney injury.

Materials & Methods
This was a prospective, observational study, in which 1000 patients were screened, all patients within the age group of 1 month to 18 years admitted in the PICU (Pediatric

Intensive Care Unit) at Basaveshwar teaching and General hospital and Sangameshwar hospital attached to Mahadevappa Rampure medical college during a period from December 2015 to Aug 2017.

Sample Size

The minimum sample size required to study the fact based on data in literature [5] with 5% level of significance. The sample size taken will be 300. Using simple random sampling method.

Inclusion Criteria

Patients aged 1 month to 18 years, admitted to pediatric intensive care unit (PICU) (Basaveshwar Teaching and General Hospital and Sangameshwar Hospital, Kalaburagi)

Exclusion Criteria

Patients with known kidney disease such as congenital polycystic kidney disease and children who were diagnosed with chronic kidney disease on first visit.

Methods of Collection of Data

Following an informed parental consent, clinical history and examination will be done, comorbidities will be noted, and relevant data regarding investigations will be collected for all children admitted to PICU.

Serum levels of creatinine estimated at admission and at daily intervals in PICU patients till discharge from PICU. Urine output measured and recorded as ml/kg/hour.

Diagnosis and staging of AKI will be based on Acute Kidney Injury Network (AKIN) definition & classification

Serum creatinine will be done on all patients admitted to PICU from day of admission till discharge from PICU. Serum creatinine of patients with AKI will be done at the time of discharge from hospital. If necessary CBC, urine routine, blood urea, serum electrolytes and USG abdomen will be done.

Statistical Analysis

Descriptive statistical characteristics and variables of the patients will be described. The biochemical and other numerical parameters will be compared using t test, Z test, and chi-square or Fischer exact test and other applicable methods. P-value <0.05 was considered as the level of significance.

Result

Maximum number of cases 380(38.0%) belongs to the age group of 1-5years, followed by 5-10years 267(26.7%) and minimum number of cases 13(1.3%) belongs to the age group of 15-18years. The mean and SD of age of boys and girls were 4.56 ± 3.84 and 4.49 ± 4.01 respectively. There was no statistical significant difference of age among males and females (P>0.05).

There were 584(58.4%) males and 416(41.6%) females in the study. The sex ratio of Male to Female was 1.4:1. Table 1

Study reveal that, maximum number of cases were observed 44(63.8%) in 3rd stage, followed by the 2nd stage 14(20.3%) and minimum number of cases 11(15.9%) were seen 1st stage.

Statistically very highly significant difference of common etiologies of Sepsis and Encephalitis among AKI and Non-AKI groups (*P*<0.001). The percentage of Sepsis and Encephalitis cases were significantly higher in the AKI cases as compared to Non-AKI cases.

There was no statistical significant difference of common etiology of pneumonia among AKI and Non-AKI groups (*P*>0.05). Table 1

Table 1: Comparison of etiology factors among AKI and Non-AKI cases

Common etiology	AKI cases (n= 69)	Non-AKI cases (n=931)	χ^2-values P-value & significance
Dengue fever	3 (4.3%)	131 (14.1%)	χ^2=5.23 *P*<0.05, S
Sepsis	11 (16.0%)	34 (3.6%)	χ^2=23.06 *P*<0.000, VHS
Encephalitis	12 (17.4%)	44 (4.7%)	χ^2=19.48 *P*<0.000, VHS
Pneumonia	2 (2.9%)	101 (10.8%)	χ^2=3.03 *P*>0.05, NS

NS= not significant, S=significant, HS=highly significant, VHS=very highly significant

Maximum number of cases 54(78.3%) belongs to the pre-renal, followed by the renal 13(18.8%) and minimum number of cases 2(2.9%) were belongs to post renal. Table 2

Table 2: Distribution of cases according to aetiology in AKI

Groups	No of cases	Aetiology		
		Pre-renal	Renal	Post-renal
AKI cases	69	54(78.3%)	13(18.8%)	2(2.9%)
Total	69(100.0%)	54(78.3%)	13(18.8%)	2(2.9%)

There was statistically significant difference in the stages and outcome in the AKI cases (*P*<0.05). The study reveal that higher the stages the percentage of improvement was lower and mortality was higher. The case fatality rate of AKI was 34.8%. Table 3

Table 3: Comparison of Staging and outcome in the AKI cases

Staging	No of cases	Outcome		χ^2-values P-value & significance
		Improved	Died	
1st Stage	11	10(90.9%)	1(9.1%)	χ^2= 4.12 *P*<0.05 S
2nd Stage	14	10(71.5%)	4(28.5%)	
3rd Stage	44	25(56.8%)	19(43.3%)	
Total	69	45(65.2%)	24(34.8%)	-

S=significant

There was statistically very highly significant difference of outcome in AKI and Non-AKI cases (*P*<0.001). The case fatality rate of Non-AKI was 1.0%.whereas the case fatality rate of AKI was 34.8%. Overall death rate was 3.3%. Table 4

Table 4: Comparison of outcome among AKI and Non-AKI cases

Groups	No of cases	Outcome		χ^2-test values P-value & significance
		Improved	Died	
AKI cases	69	45(65.2%)	24(34.8%)	χ^2= 230.19 P<0.000 VHS
Non-AKI cases	931	922(99.0%)	9(1.0%)	
Total	1000	967(96.7%)	33(3.3%)	--

VHS=very highly significant

Discussion

AKI is a clinical condition that commonly occurs in critically ill patients in the pediatric intensive care unit. Studies has shown AKI is independently associated with poor outcome. Published data about AKI in Indian children are limited. Most data available are from developed countries. Very few Indian studies provide incidence of AKI in pediatric ICU. The purpose of this study is to understand the outcome of acute kidney injury in children admitted to pediatric intensive care unit of a tertiary care center.

In the present study, median age was 4.56% among boys and girls constituted 4.49%, 58% were boys among AKI patients which is comparable to Krishnamurthy *et al* [5] study.

In the present study, AKI Stage 1, 2, 3 was diagnosed in 11 (15.9%), 14 (20.3%) and 44(63.8%) of AKI patients. Maximum numbers of AKI patients were in Stage 3. Similar to Krishnamurthy *et al* [5]. Where the maximum numbers of AKI patients were in Stage 3.

Table 5: AKI staging among different studies

Stages	Study		
	Present	Krishnamurthy *et al.* [5]	Ts Prabhakar *et al* [6]
Stage 1	15.9%	35.2%	85.7%
Stage 2	20.3%	25.9%	11.4%
Stage 3	63.8%	38.9%	2.9%

In the present study, the most common condition associated with AKI was sepsis, followed by encephalitis, cardiac causes, DKA, dengue, and gastroenteritis in decreasing order of occurrence. In Krishnamurthy *et al* [5]. Studies, pneumonia was the most common disease associated with AKI.

In the present study, pre-renal causes accounted for (54) 78.3% of AKI. This is different from other previous studies such as Krishnamurthy *et al* [5]. Garuda Rama *et al* [4] study prerenal cases were more followed by renal and post renal. Which is comparable to our study. In our study renal cases accounted for (13) 18.8%, post renal (2)2.9%.

The mortality in present study was 34.8%, which is higher than study conducted by Krishnamurthy *et al* [4]. But lower than other researcher like Garuda Rama *et al* [4] and Srinivasa *et al* [4]. The mortality in present study was comparable to Mehta *et al* [1].

In the present study, mortality was 9.1% in Stage 1 and 28.5% in Stage 2. Stage 3 it is 43.3%. Mortality was high in stage 3.

In the present study, the median duration of PICU and Hospital stay was 9.98±7.27 in AKI group compared to7.41 ± 5.62 days in Non AKI group (p<0.001). This is comparable to Mehta *et al* [1] study, where the mean duration of hospital stay was 9 days and 7 days in AKI and Non AKI group. Both the studies support the fact that in the presence of AKI, the PICU and Hospital stay increases

Conclusion

It was concluded that the most common condition associated with AKI was sepsis, encephalitis. Pre-renal causes accounted for (54) 78.3% of AKI. In the present study, AKI Stage 1, 2, 3 was diagnosed in 11 (15.9%), 14 (20.3%) and 44(63.8%) of AKI patients. Maximum number of AKI patients were in Stage 3 (p<0.001). 63.8%. AKI was associated with increased mortality (p<0.000).mortality rate was 34.8% compared to non AKI. In the present study, mortality was 9.1% in Stage 1 and 28.5% in Stage 2. Stage 3 it is 43.3%. Mortality was high in stage 3.

It is emphasized that the incidence of AKI is high in children. AKI continues to be associated with adverse outcomes, including high mortality and morbidity. Early diagnosis of AKI using new defined criteria (AKIN, RIFLE, p RIFLE) along with early and appropriate management of risk factors will prevent the progression of AKI and decrease the mortality and morbidity of AKI patients.

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