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. Serum creatinine will be done on all patients admitted to PICU from day of admission till discharge from PICU.

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 1-5 years, followed by 5-10 years 267(26.7%) and minimum number of cases 13(1.3%) belongs to the age group of 15-18 years. 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

| Common etiology   | AKI cases (n=69) | Non-AKI cases (n=931) | \( \chi^2 \)-values | P-value & significance |
|-------------------|-----------------|-----------------------|---------------------|------------------------|
| Dengue fever      | 3 (4.3%)        | 131 (14.1%)           | \( \chi^2=5.23 \)    | P<0.05, S              |
| Sepsis            | 11 (16.0%)      | 34 (3.6%)             | \( \chi^2=23.06 \)   | P<0.000, VHS           |
| Encephalitis      | 12 (17.4%)      | 44 (4.7%)             | \( \chi^2=19.48 \)   | P<0.000, VHS           |
| Pneumonia         | 2 (2.9%)        | 101 (10.8%)           | \( \chi^2=3.03 \)    | 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 belonged to post renal. Table 2

| Groups | No of cases | 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

| Staging | No of cases | Outcome | Died | \( \chi^2 \)-values | P-value & significance |
|---------|-------------|---------|------|---------------------|------------------------|
| 1st Stage | 11          | Improved | 19(19.1%) | \( \chi^2=4.12 \) | P<0.05, S |
| 2nd Stage | 14          | Improved | 4(28.5%)  | -                   | S                     |
| 3rd Stage | 44          | Improved | 19(43.3%) | -                   | -                     |
| Total   | 69          | Improved | 24(34.8%) | -                   | -                     |

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
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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