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STUDY OF ACUTE KIDNEY INJURY IN CHILDREN ADMITTED TO PEDIATRIC INTENSIVE CARE UNIT

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ABSTRACT

The incidence of Acute Kidney Injury (AKI) in children appears to be increasing, and the aetiology of AKI over the past decades has shifted from primary renal disease to multifactorial causes, particularly in hospitalized children. Prospective, observational study. 200 number of children aged between 1-12 years, admitted in Paediatric Intensive Care Unit in Government General Hospital; Siddhartha Medical College; Vijayawada, during the period Nov 2012 to Nov 2013. This study aims to determine the incidence of Acute Kidney Injury in children (age group 1 – 12yrs) admitted to PICU and the outcome of children affected with AKI. The overall incidence of AKI in children admitted to Paediatric intensive care unit was 17.5% (35 out of 165). The morality rate was 28.57% in children with AKI (10 out of 35).The risk factors for AKI include: younger age, sepsis and shock with Multi-organ dysfunction and need for mechanical ventilation. The need for dialysis was present in 34.2% of children with AKI (12 out of 35). AKI continues to be associated with adverse outcomes, including high mortality and partial renal recovery. Hence larger multicentre studies were further required for a clearer understanding of the long term outcomes of this condition which would allow optimization of follow-up strategies.

Key Words: Acute kidney injury, Paediatric, creatinine, dialysis.

INTRODUCTION

Acute kidney injury (AKI) (previously called acute renal failure) is characterized by a reversible increase in the blood concentration of creatinine and nitrogenous waste products and by the inability of the kidney to regulate fluid and electrolyte homeostasis appropriately (Springer Pediatc Nephrol, 2009). The incidence of AKI in children appears to be increasing, and the aetiology of AKI over the past decades has shifted from primary renal disease to multifactorial causes, particularly in hospitalized children (Basu RK *et al* 2009; Askenazi DJ *et al* 2006; Palmieri T *et al* 2009).

Mortality rates in critically ill children with AKI are high (Askenazi DJ *et al* 2011) and increases from 10% to 57.1% in patients with multi-organ failure, marrow or solid organ transplantation, or acute respiratory distress syndrome (Askenazi DJ *et al* 2011). Most paediatric studies on the incidence of AKI are limited to the developed countries (Askenazi DJ *et al* 2006; Akcan A *et al* 2007; Schneider J *et al* 2010; Zappitelli M *et al* 2011; Zappitelli M *et al* 2008) and are based on retrospective analysis of records (Askenazi DJ *et al* 2006; Schneider J *et al* 2010).

Given that the spectrum of AKI differs in developing countries and that retrospective ascertainment of diagnosis is difficult, we aimed to study the incidence and outcome of Acute kidney injury in children admitted in PICU in Department of Paediatrics; Government General Hospital, Vijayawada.

MATERIAL AND METHODS

STUDY DESIGN

Prospective, observational study.

DURATION OF STUDY

November 2012 - November 2013.

SUBJECTS

All the children aged between 1-12 years, admitted in Paediatric Intensive Care Unit in Government General Hospital; Siddhartha Medical College; Vijayawada.
Sample Size: 200

INCLUSION CRITERIA

1. Age: All children in the age group 1 – 12 yrs.
2. Children admitted in Paediatric Intensive Care Unit; Government General Hospital; Vijayawada ; in whom serum creatinine is done within 48hrs of illness.

EXCLUSION CRITERIA

1. Congenital kidney anomalies.

2. Known case of AKI or chronic kidney disease at admission.
3. Hospital stays for less than 24 hrs.
4. Serum creatinine not done at admission or at 48hrs.
5. Post operative surgery patients (cardiovascular, abdominal, neurological or orthopaedic surgeries).

METHOD

This prospective study was carried out in children between the ages of 1- 12 years, admitted to the Paediatric intensive care unit (PICU), in Siddhartha Medical College. The study was approved by the Institute Ethics Committee. About 200 children admitted to PICU and which fulfilled the inclusion criteria were included in the study group. Following informed parental consent, information regarding the diagnosis, co morbidities and the serial serum creatinine levels were recorded shock (KDIGO 2012, Srivastava RN *et al* 1990). For all the children serum creatinine levels were done within 48hrs of illness and then repeated every consecutive day. Results were analyzed using Medcalc software by student t test and chi-square test and Microsoft excel Windows 7. Continuous data were expressed as mean ± Standard deviation and categorical variables as number (n %). The probability value (p-value) ≤ 0.05 was taken as statistically significant value.

RESULTS

Out of the 200 children, 35 children were found to have Acute Kidney Injury and in remaining 165 children no AKI was found on monitoring serum creatinine levels.

THE CLINICAL CHARACTERISTICS OF THE CHILDREN IN STUDY GROUP

The age (mean± SD) in children with AKI was 26.8 ± 2.2 months and in children without AKI was 37.2 ± 3.1 months which was statistically significant (p = 0.0001).

The serum creatinine levels (mg/dl) at admission were found to be 1.107 ± 0.328 in children with AKI and 0.663 ± 0.154 in children without AKI, which was found to be significantly higher in children with AKI at admission. The number of girls in children with AKI were 18 (51%) and in children without AKI were 90 (54%) and remaining being boys in both groups which was not statistically significant.

INCIDENCE OF AKI

Out of 200 children admitted to PICU who were included in the study, 35 were found to have AKI, out of which Stage I --- 30 (85.7%) , Stage II --- 4 (11.4%) & Stage III --- 1 (2.9%). Thus the incidence of Acute Kidney Injury in children admitted to paediatric intensive care unit was found to be 17.5**%.**

The risk factors of AKI were young age (26.8 ± 2.2 months), Sepsis and Shock, as the incidence of AKI in younger children and in children with Sepsis or shock were statistically significant.

Table: 1 Risk factors of Acute Kidney Injury in children

Factors	AKI group N = 35	No AKI group N = 165	p value	Statistical significance
Age (Mean ±SD) months	26.8 ± 2.2	37.2 ± 3.1	0.0001	Significant
Shock (n%)	9 (25.7%)	15 (9.09%)	0.006	Significant
Sepsis (n%)	11 (31.4%)	20 (12%)	0.004	Significant

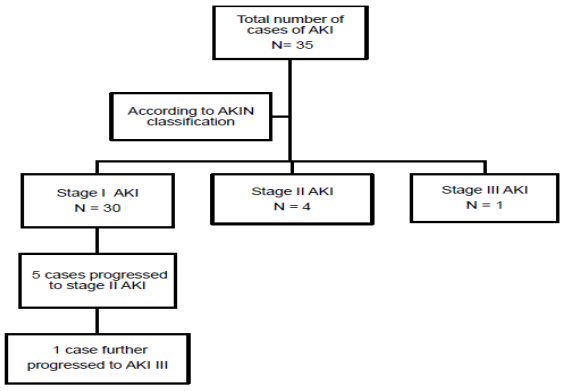
OUTCOME OF CHILDREN WITH AKI

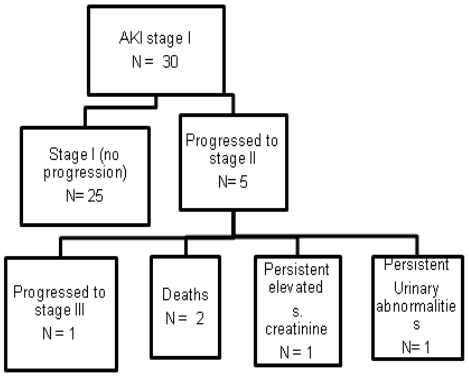
Out of 200 children admitted in PICU, 35 were found to have Acute Kidney Injury. Out of which, 30 children were in AKI stage I, 4 children in AKI stage II, and 1 in AKI stage III.

OUTCOME OF CHILDREN WITH AKI STAGE I

We had 30 children with AKI stage I, 5 children progressed to AKI stage II, and out of the remaining 25 children, 18 children recovered completely with return of serum creatinine levels to normal, and without persistent hypertension or urinary abnormalities & the rest 7 children who did not have complete recovery, 1 child had persistent hypertension, 1 child had persistent urinary abnormalities and 2 children had persistent elevated serum creatinine levels and the other 2 children died.

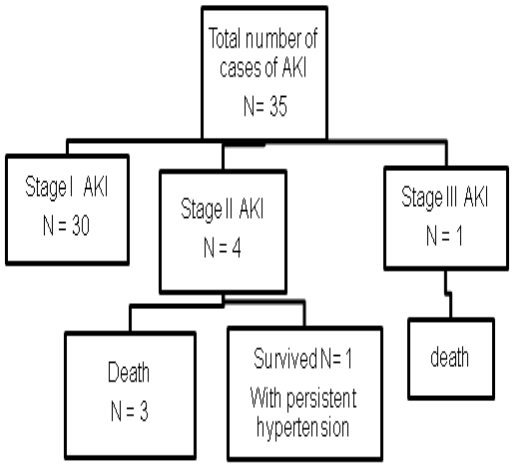
Out of the 5 children who progressed from AKI stage I to AKI stage II, 2 children expired, 1 child had persistent urinary abnormality and 1 child had persistent elevated serum creatinine, and 1 child progressed from stage II to stage III.





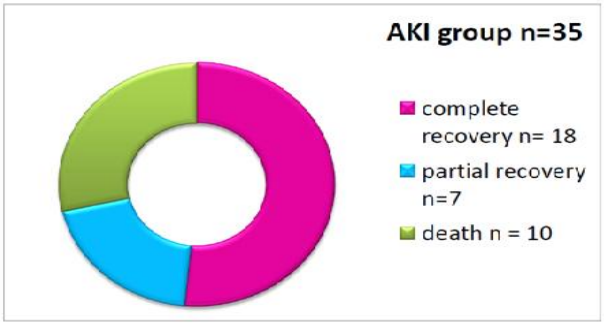
OUTCOME OF CHILDREN WITH AKI STAGE II AND AKI STAGE III

Out of the 4 children with stage II AKI, 1 child had persistent hypertension and the other 3 expired. The 1 child in AKI stage III, expired.



COURSE OF RECOVERY IN CHILDREN WITH AKI

Out of the 35 children with AKI, 25 children survived, of which, 18 (72%) children had complete recovery, 7 (28%) children had partial recovery and deaths were 10 (28.57%).



DISCUSSION

In the present study, the incidence of AKI, according to Acute Kidney Injury Network Criteria, in children admitted to PICU was 17.5%. And the risk factors of AKI were Sepsis and Shock, as the incidence of AKI was significantly higher in children with sepsis and shock (Hoste EA *et al* 2006; Joannidis M *et al* 2009; Ozcakar ZB *et al* 2009; Duzova A *et al* 2010; Poonam M *et al* 2011; Nazni et.al., 2008, Nazni et.al., 2009 and Nazni et.al., 2010).

In the present study as AKIN criteria was used for the classification of AKI, which might have lead to a relatively higher incidence of AKI stage I.

The present study was conducted in a single site and this could have led to an involuntarily selection of patients with pathologies usually seen in our hospital;

However, this effect could have been lessened because many of the patients admitted to the ICU are referred from other health facilities and because the study's prospective design allowed for an analysis of all hospitalized patients throughout the study.

One consideration to be made in relation to surviving patients is that they have a high risk of long-term renal complications. Thus further studies with multicenter trails and multivariate analysis were required for early detection of AKI and early intervention in order to decrease the mortality and morbidity due to acute kidney injury.

In the present study, 28% of the children who survived AKI developed renal impairment, and such finding highlights the importance of long-term follow-up in children with acute kidney injury.

CONCLUSION

This is an observational study to document the incidence, clinical profile and outcomes of children with AKI admitted to the pediatric intensive care unit. The conclusions of the study were: The overall incidence of AKI in children admitted to Pediatric intensive care unit was 17.5% (35 out of 165). The morality rate was 28.57% in children with AKI (10 out of 35). The risk factors for AKI include: younger age, sepsis and shock with Multiorgan dysfunction and need for mechanical ventilation. Complete renal recovery was present in 72% (18 out of 25) of the total children who survived. Partial renal recovery (in the form of persistent hypertension, elevated serum creatinine, persistent urinary abnormalities) was present in 28% (7 out of 25) of children who survived. The need for dialysis was present in 34.2% of children with AKI (12 out of 35). AKI continues to be associated with adverse outcomes, including high mortality and partial renal recovery. Hence larger multi centered studies were further required for a clearer understanding of the long term outcomes of this condition which would allow optimization of follow-up strategies.

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