RESEARCH

INCIDENCE AND OUTCOME OF ACUTE KIDNEY INJURY IN CHILDREN ADMITTED IN PEDIATRIC INTENSIVE CARE UNIT

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Abstract

Background: An acute decline in renal function is often secondary to an injury that causes functional or structural changes in the kidneys. The objective is to determine the incidence and outcome of AKI in children admitted in PICU. **Materials and Methods:** This study was carried in patients age of 1 month to 18 years admitted in the PICU tertiary care. **Result:** rate of new pts of AKI was 6.9%. There was no difference of age among AKI and Non-AKI study participants (P>0.05). But more cases are reported in the lower age. 63.8% cases were observed in 3rd stage, followed by the 2nd stage 14(20.3%) and 15.9% cases were seen 1st stage. There was no statistical significant difference of common etiology of pneumonia among AKI and Non-AKI groups. (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%. **Conclusion:** The mean ± SD of age of boys and girls were 4.56 ± 3.84 and 4.49 ± 4.01 respectively. Maximum number of AKI patients were in Stage 3 ($p < 0.001$). The higher the stages of AKI, the higher were the risk of mortality ($p < 0.001$).

INTRODUCTION

AKI occurs in 2-3% of children admitted to tertiary care centres and as many as 8% if infants in neonatal ICUs. A classification system has been proposed to standardize the definition of AKI adults. After pediatric cardiac surgery acute renal injury is common and associated with more mechanical ventilation and hospital stay. Risk of acute kidney injury associated with age and cardiopulmonary bypass time which may be a marker for case complexity.[1] Different researchers have revealed to identify the risk factors for development of AKI in critically ill children. Mehta et al find out that younger age, shock, sepsis, and need for mechanical ventilation where independent risk factors were AKI in their cohort.[2,3] Nephrotoxic drugs responsible for about 16% of all AKIs most commonly associated with AKI in older children and adolescents. NSAIDs, antibiotics, amphotericin B, antiviral agents, angiotensin-converting enzyme (ACE) inhibitors, calcineurin inhibitors, radiocontrast media, are the most important drugs to indicate AKI as significant risk factor in children.[4]

AKI has become increasingly prevalent in both developed and developing countries, and is associated with severe morbidity and mortality, especially in children. In developed countries, prevalence of AKI occurs greater in urban ICUs and is related to sepsis and multi organ failure, excess mortality, and occurrence in higher age populations. While urban areas of developing and developed world have same characteristics to those in the patients of AKI.

In rural areas, in response to a single disease and specific conditions (e.g. gastroenteritis) or infections (e.g. severe malaria, leptospirosis, or hemolytic-uremic syndrome), Acute renal Injury commonly develops in younger otherwise healthy individuals.

In rural settings, different causes (as diarrhea, poisoning, malaria, or septic abortion) of AKI can be prevented by interventions at the individual, community, and regional levels.[5]

In different geographical areas The causes of AKI differs according to the prevalent disease pattern and available health care facilities.

HUS was a leading cause of AKI at most referral centers for many years (1976-1993), but its incidence has decreased. The most common conditions associated with ARF are Acute GN and ATN. Snakebite is an important cause in coastal regions of south India, Orissa and in rural areas. In some parts of Kerala leptospirosis is frequently encountered. In Korea and China Hantavirus infections are important.[6]

Hence, this research is conducted to find out the incidence and result of Acute Kidney Injury in children admitted in PICU.

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MATERIALS AND METHODS

This study was conducted among patients age of 1 month to 18 years admitted in the Pediatric Intensive Care Unit at Basaveshwar teaching and General hospital and Sangameshwar hospital attached to Mahadevappa Rampure Medical College. Study period was from December 2015 to May 2017.

Inclusion Criteria

Patients admitted to Pediatric intensive care unit aged 1 month to 18 years,

Exclusion Criteria

Known kidney disease such as congenital polycystic kidney disease.

Children suffering from chronic kidney disease on first visit.

Methodology

After taking informed consent (Parentral), clinical history and examination will be done, other associated disease will be noted, and related data regarding investigations will be collected for all children.

At admission and at daily intervals till discharge from PICU, estimation of serum creatinine was done. Unit of urine output is noted as ml/kg/hour.

Acute Kidney Injury Network (AKIN) definition & classification was used for diagnosis and staging of AKI.

At the time of discharge from hospital, All patients with AKI advised for serum creatinine. If needed Complete Blood Count, urine routine, blood urea, serum electrolytes and ultrasound abdomen will be done.

Statistical Analysis

Number, percentage were used. To compare the biochemical and other numerical parameters chi-square test, t test, Z test were used.

RESULTS

The mean and Standard Deviation for age were 4.56 and 3.84, 4.49 and 4.01 for boys and girls respectively. Both genders are similar with age. Out of total, 584(58.4%) were males and 416(41.6%) were females in this research. Male to Female sex ratio was 1.4:1

Rate of new cases of Acute Kidney Injury was 6.9% in the current study. In regard to the incidence of AKI, both the study subject group were similar (no statistical significant difference) in relation to age. But cases are greater in number in the lower age groups.

Male and Female cases in this research were forty (58.0%) and twenty (42.0%) respectively. The sex ratio of AKI participants of female to male were 1: 1.38. This is nearly similar to the total cases There was no difference (P>0.05). of sex among AKI and Non-AKI groups

Anuria, Gross hematuria and Encephalopathy among AKI and Non-AKI groups patients were significantly associated (P<0.001). Vomiting, diarrhoea in AKI and without AKI groups were statistically significantly associated (P<0.05). The presentation of absence of urine, Gross hematuria, Encephalopathy, Vomiting and Loose motion were significantly less in the non-AKI cases.

Presentation of Oliguria, Fever, Seizures, Breathlessness and Gl. Hemorrhage were similar in both the cases i.e AKI and Non-AKI participanrs.

The mean and SD age of AKI cases of Hospital stay in terms of mean and standard deviation were 9.98 and 7.27, 7.41 ± 5.62 in both the cases. For all the cases overall Mean and Standard Deviation was 7.62 ± 5.73

Significantly higher ventilation and hypovolemia were noted in the AKI cases as compared to Non-AKI cases.

Blood urea and serum creatine among AKI and Non-AKI groups were significant. Level of Mean Blood urea and Serum creatine were more in the AKI cases as compared to Non-AKI cases.

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.

Very highly significant difference of common etiologies of Sepsis and Encephalitis among both the patients group. The percentage of Sepsis and Encephalitis in the AKI cases were more than to Non-AKI cases.

Common aetiology of pneumonia among Acut renal Injury and Non-AKI participants were similar (P>0.05). [Table 1]

Mostly 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]

Statistically significant difference in the stages and outcome in the AKI cases (P<0.0 was noted. The study reveals 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]

There was highly significant of outcome in AKI and Non-AKI cases (P<0.001).

The case fatality rate of Non-AKI and AKI were 1.0% and 34.8% respectively. Overall death rate was 3.3%. [Table 4]

Table 1: Aetiology among both the study groups

Common etiology	AKI patients (69)	Non-AKI patients (931)	$\chi 2$, P-value
Dengue fever	3 (4.3%)	131 (14.1%)	$\chi 2$=5.23 P<0.05,
Sepsis	11 (16.0%)	34 (3.6%)	$\chi 2$=23.06 P<0.000,

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Encephalitis	12 (17.4%)	44 (4.7%)	$\chi 2$=19.48 P<0.001,
Pneumonia	2 (2.9%)	101 (10.8%)	$\chi 2$=3.03 P>0.05,

Table 3: Cases according to etiology in Acute Kidney Injury

Groups	No of cases	Etiology		
		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%)

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

Staging	No of cases	Outcome		$\chi 2$-test values P-value
		Improved	Died	
1st Stage	11	10(90.9%)	1(9.1%)	$\chi 2$= 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%)	--

Table 4: Comparison of outcome among AKI and Non-AKI study participants

Groups	No.	Outcome		$\chi 2$-test, P-value
		Improved	Died	
AKI cases	69	45(65.2%)	24(34.8%)	$\chi 2$= 230.19 P<0.000
Non-AKI cases	931	922(99.0%)	9(1.0%)	
Total	1000	967(96.7%)	33(3.3%)	

Table 5: Comparison of causes of AKI

Study	Prerenal	Renal	Post renal
Present	78.3%	18.8%	2.9%.
Garuda Rama et al,[9]	50%	40%	10%

Table 6: Mortality shown in various studies

Study	Mortality
Present	34.8%
Krishnamurthy et al.[7]	17.5%
Mehta et al.[2]	37%
Garuda rama et al.[9]	57%
Srinivasa et al.[10]	72.3%

DISCUSSION

In comparison to other Indian researchers by Krishnamurthy et al,[7] and Mehta et al,[2] in the present study, the lower rate of incidence of AKI ie 6.9% was found. This difference was due to Heterogeneity of study subjects population, diverse regional differences, and sample sizes.

Median age was 4.56% and 4.49% respectively among boys and girls. Comparable to Krishnamurthy et al,[7] study, 58% were boys among AKI patients in the present study.

There are many etiology for AKI across the globe. Sepsis, HUS, ATN mainly in developing countries, in west these have been replaced by heamatooncologic complications and pulmonary failure as causes of AKI. In the present study sepsis followed by encephalitis was leading cause of AKI which is comparable to Krishnamurthy et al7 study and Mehta et al study.[2]

Another researcher Shweta naik et al8 revealed that presence of infection, sepsis were significant predictors of AKI which is comparable to our 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,[7] where the maximum numbers of AKI patients were in Stage 3.

In the present study, the most common condition associated with AKI was sepsis, followed by encephalitis, cardiac causes, DKA, dengue, and gastroentritis in decreasing order of occurrence. Krishnamurthy et al,[7] and Mehta et al,[2] found in their researches that pneumonia was the most common disease associated with AKI.

In the present study, 78.3% of AKI was due to pre-renal cause. This is different from other previous studies such as Krishnamurthy et al,[7] and Mehta et al.[2] Garuda rama et al,[9] 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% and post renal (2)2.9%. [Table 5]

In present study mortality was 34.8%, which is comparable to Mehta et al2 study. In stage 1,2,3 mortality were 9.1%, 28.5% and 43.3% respectively. Mortality was high in stage 3 in the present study,

CONCLUSION

Incidence of AKI was 6.9% in Pediatric Intensive Care Unit. Mean± SD of age of boys and girls were 4.56 ± 3.84 and 4.49 ± 4.01 respectively. Most of

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AKI study subjects were in Stage 3 ($p < 0.001$). The higher the stages of AKI, the higher were the risk of mortality ($p < 0.001$). 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, pRIFLE) 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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