Original Article

Frequency of Acute Kidney Injury Among Septic Children, Admitted at a Tertiary Care Hospital

Acute Kidney Injury Among Septic Children

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ABSTRACT

Objective: The objective of our study was to determine the frequency of acute kidney injury (AKI) among septic patients admitted at a tertiary care hospital.

Study Design: Descriptive / observational study

Place and Duration of Study: This study was conducted at a Tertiary Care Hospital of Karachi from 1st July 2015 to 31st December 2015.

Materials and Methods: Total 237 patients who were diagnosed as having sepsis with age 1 to 144 months were included in the study. These patients were monitored till the development of acute kidney injury (AKI).

The frequency and percentages were calculated for qualitative variables i.e. gender, and age group, while mean and standard deviation was calculated for quantitative variables i.e., age, baseline serum creatinine, maximum serum creatinine and hospital stay. P-value ≤0.05 was considered as significant.

Results: Total 237 patients were included in study with age 1 to 144 months 61.93(±33.510). Out of 237 patients 62 i.e. (26.2%) developed Acute Kidney Injury (AKI). A significant association of acute kidney injury was observed with hospital stay (p<0.001) and male gender (p=0.045). No significant association of acute kidney injury was observed with age (p=0.737) and baseline serum creatinine (p=0.104).

Conclusion: Development of Acute kidney injury is common in septic children and is significantly associated with increased hospital stay. This study provides statistics of sepsis induced AKI in the local population. In addition, the results emphasize on early identification of AKI among septic children to prevent further morbidity and mortality.

Key Words: Acute Kidney Injury, Risk factors of Acute Kidney Injury, Pediatric sepsis, Sepsis induced Acute Kidney Injury.

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INTRODUCTION

Acute kidney injury (AKI) is a pathological term which is described as reversible and abrupt loss of renal function associated with decreased urine output or increased serum creatinine and urea level. It is characterized by a decline in renal function, decreased excretion of waste products, and dysregulated fluid homeostasis[1,2]. Multiple studies have shown that there is a higher incidence of AKI among hospitalized children which ranges from 35% to 85%[3,4,5]. Many predisposing factors have been reported that lead to AKI among which sepsis is an important risk factor[6].

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There is limited local data on etiological profile of Pediatric AKI. One study from Karachi found sepsis to be the most common cause of pre renal AKI in children[7]. Another study conducted in Multan states sepsis as one of the common risk factors of AKI in neonates, however most of the studies are still concentrated in developed countries and data on pediatric AKI in developing countries remain scarce[8].

Sepsis is a syndrome of pathologic, physiologic and biochemical abnormalities triggered by infection. Development of AKI during sepsis is one of the most feared complications and is associated with an increased duration of stay which ultimately leads to poor outcome. [3,9,10,]. AKI occurs in around 19% of patients who have moderate sepsis while its frequency increases with increase in severity of sepsis, approximately 50% of patients who have septic shock develop AKI[11.]

The keystone of prevention and management of AKI in sepsis is the early restoration of adequate renal perfusion and timely commencement of antimicrobial therapy [12,13].

Considering the increasing frequency of AKI in hospitalized children, and limited studies on pediatric AKI in our country, we have conducted this study to

identify the frequency of AKI among septic children, so that early identification can be done, protective and preventive strategies can be made timely and optimal renal support can be started if the renal function declines.

MATERIALS AND METHODS

Descriptive observational study was conducted for six months from 1st July 2015 to 31st December 2015 at Department of Pediatrics, of a tertiary care hospital of Karachi. The approval letter was issued by Research Evaluation Unit, CPSP with reference number CPSP/REU/PED-2012-183-2278. WHO software for sample size calculation was used, considering p=19%of AKI, d=5%, and 95% confidence interval, the calculated sample size was 237 study subjects. Non-probability consecutive sampling was used. All children aged 01 month to 12 years diagnosed as having sepsis, with hospital stay of at least 48 hrs and with baseline serum creatinine level ≤ 1 mg/dl at the time of admission were included in study. Children with chronic kidney disease stage 5 or those who have congenital renal anomalies were excluded from study.

Total 237 patients who were admitted in the Pediatrics ward diagnosed as having sepsis and fulfilling the inclusion criteria were included in the study. Children were diagnosed with sepsis as defined by International Pediatric Sepsis Consensus 2005[14]. Patients were said to have SIRS (Systemic Inflammatory Response Syndrome) if they have the presence of either core body temperature of more than 38.5°C or less than 36°C or leukocyte count or heart rate or respiratory rate elevated for age (any two of the above mentioned). Infection was suspected in patients if they have any evidence of infection based on clinical examination, radiological imaging or laboratory parameters consistent with infection[14]. Infection was said to be proven in the presence of positive blood or body fluids cultures. Children were diagnosed with sepsis if they have clinical characteristics of SIRS in presence of either suspected or proven infection. After explaining the purpose and procedure of the study a written informed consent was taken from parents/guardians of the patients. Patient's clinical history was taken by the principal investigator on a predesigned proforma. Serum level of creatinine was done at admission and thereafter every 48hrs in all patients till their total hospital stay. The patients were carefully evaluated to ascertain the development of AKI. AKI was defined as an increase in serum creatinine levels by 0.3 mg/dl within 48 hours or a 50% increase in serum creatinine from the patient's baseline serum creatinine levels, as defined by the Acute Kidney Injury Network (AKIN)[2.] Confounding variables and biases were controlled by strictly following inclusion and exclusion criteria.

Data compilation and analysis was done using Statistical Program for Social Sciences (SPSS) version 21. Results were expressed as mean ± SD for all quantitative variables i.e. age, hospital stay and serum creatinine level (mg/dl). The frequency and percentages were calculated for qualitative variables i.e. gender, and age group, while mean and standard deviation was were calculated for quantitative variables i.e. age, baseline serum creatinine, maximum serum creatinine and hospital stay, p-value ≤0.05 was considered as significant. The p-value was calculated for qualitative variables using chi square test and for quantitative variables using independent t-test.

RESULTS

Total 237 patients of either gender with age 1 to 144 months, diagnosed as having sepsis with baseline serum creatinine less than or equal to 1 mg/dl and with hospital stay of at least 48 hours were evaluated to determine the frequency of Acute Kidney Injury (AKI). The results showed that there were 131(55.3%) male and 106(44.7%) female patients. The mean age of the patients was 61.93±33.5 months.(Tabel-1). Mean baseline serum creatinine was 0.44±0.15 mg/dl while mean maximum serum creatinine was 0.827±0.63 mg/dl. The mean hospital stay was 131.44±51.1 hrs. (Table-1).

Table No.1: Showing basic Characteristics of Study participants (n=237)

Qualitative Variables	Frequency (N)	Percentage (%)
Sex		
Male	131	(55.3)
Female	106	(44.7)
Age category		
≤ 60 months	141	(59.5)
> 60 months	96	(40.5)
Quantitative Variables	Mean	±SD
Age(months)	61.93	±33.510
Baseline Serum Creatinine (mg/dl)	0.44	±0.148
Maximum Serum Creatinine (mg/dl)	0.827	±0.633
Hospital Stay (hrs)	131.44	±51.103

Table No.2: Showing association of Acute Kidney Injury with baseline characteristics (n=237)

Characteristics	Frequency (n)	Acute Kidney Injury		*P* value
		Yes (n=62)	No (n=175)	
SEX				
Male	131	41(31.3)	90(68.7)	0.045 *
Female	106	21(19.8)	85(80.2)	
AGE				
≤ 60 months	141	38(27.0)	103(73.0)	0.737
> 60months	96	24(25.0)	72(75.0)	

*Chi square test was applied; p-value ≤0.05 considered as significant

Table No.3: Showing comparison of Mean between AKI and Non AKI patients (n=237)

Variable	Acute Kidney Injury(AKI)		P-value
	Yes (n=62)	No (n=175)	
Baseline Serum Creatinine Mean(SD)	0.468 (.1212)	0.432 (.1565)	0.104
Hospital stay (Hours) Mean(SD)	152.53(56.91)	123.97 (46.81)	<0.001*

Student t- test was applied; p-value ≤0.05 considered as significant

Most common cause of infection in our study was Community Acquired Pneumonia in 58 patients (24.5%), followed by typhoid fever in 36 patients (15%), meningitis in 28 patients (12%), urinary tract infections in 27 patient (11.5%) encephalitis in 21 patients (9%), dengue fever in 18 patients (7.5%), pulmonary tuberculosis in 17 patients (7%) and malaria in 15 (6%) and skin infections in 11 patients(4.5%). In addition there are also cases of sepsis with more than one focus of infection, which is found in 28 patients (12%)

Table 2 shows the main outcome i.e. Acute kidney Injury was observed in 62(26.2%) patients. We observed that 41(31.3%) of the male patients developed AKI as compared to 21 (19.8%) of female patients and a significant association of development of AKI was observed in male patients (p=0.045). Moreover 27% of the patients who were ≤ 60 months had AKI as compared to 25% of patients who were > 60months, thus no significant association of AKI was observed with the age of patients(p=0.74).

Independent test was applied to observe the association of AKI with baseline serum creatinine and hospital stay. There was a significant association of AKI with increased hospital stay (p<0.001). However, no significant association of acute kidney injury with baseline serum creatinine (p=0.104). (Table 3)

DISCUSSION

Sepsis-induced AKI is has a unique identity of its own and sepsis has been found to be a major contributing factor leading to acute kidney injury in critical illness[15]. In our study, out of 237 patients who were diagnosed as sepsis, AKI was found in 62 patients which comprised 26.2% of patients. This data was consistent with a study of Fitzgerald et al who found that 21% of the patients with sepsis had severe AKI and was associated with poor outcomes[1]. Ganda et al found that 40% of the patients diagnosed with sepsis developed AKI[15]. In another large pediatric cohort, infection was found to be a major risk factor[16]. Likewise, infection was identified as an independent predictor of AKI in a cohort conducted in South Nigeria[17]. Similar studies have been conducted showing sepsis as one of the important risk factors of AKI however, data vary widely[11,12,18,19]. Additionally, a notable percentage of the patients who survive after kidney disease ended up in early end-stage kidney disease leading to death[20]. In a recent study by Riyuzo et al, a mortality rate of 33.7% was found in patients with sepsis-associated acute kidney injury[10].

Total duration of hospital stay was significantly higher in patients with AKI with sepsis, compared to non-AKI septic patients (p=0.007). In a study of adult population Alobaidi et al also concluded that length of stay was longer in patients with sepsis associated Acute Kidney Injury as compared to sepsis alone.[12] Fitzgerald et al had also found a significant association between longer hospital stay and development of acute kidney injury[1]. Another large cohort study also reported an increased duration of hospital stay in patients with sepsis-associated acute kidney injury when compared with non-septic AKI or sepsis alone[21].

Moreover, in our study we found a significant association of acute kidney injury with male gender, this finding was consistent with a meta analysis of an adult population done by Grams et al[22]. However, most pediatric studies did not find any association of AKI with gender[6,15]. There was no significant association of development of acute kidney injury with baseline serum creatinine.

We didn't find any association of age with the development of AKI, however Mehta et al had reported that young age was one of the risk factors for the development of AKI[2]. McGregor et al had also found that patients with younger age were more likely to develop acute kidney injury[23]. Unfortunately there is no single agreement to define which parameter is better for early identification of acute kidney injury. Although serum creatinine test is cost effective, some limitations exist. After renal parenchymal injury there is a compensation mechanism which can lead to a delay in the creatinine rise. Fortunately, with the newer emerging biomarkers early identification of AKI is possible[24].

Our study has few limitations, the data used for this study was derived from a single tertiary care hospital and our single center survey was conducted with small sample size and in an urban environment therefore, the results might not be generalizable to larger populations. Our AKI definition was based on the AKIN criteria for changes in serum creatinine but did not include urine output or an estimation of glomerular filtration rate. Furthermore, our data cannot determine mortality due to sepsis-associated acute kidney injury, however our results suggest that acute kidney injury should be suspected early in septic patients. Increasing awareness of acute kidney injury among health care providers

would definitely increase their concern. This could lead to more cautious use of nephrotoxic drugs, renal dosing of medications, avoidance of contrast exposure and other insults in suspected or confirmed cases of AKI, thus avoiding further renal injury[9].

Given the global and ubiquitous impact of AKI and sepsis, an understanding of SA-AKI is now essential for the clinicians for appropriate plan recognition, treatment and follow-up strategies. Furthermore, studies also suggest that it is important to have increased vigilance on patients who survive for the sequelae of chronic renal damage[20].

CONCLUSION

Acute Kidney Injury is a common complication in septic children and it is associated with increased hospital stay. This study provides statistics of sepsis induced AKI in the local population. In addition the results also emphasize on early identification of AKI among septic children so that measures would be taken early to prevent further morbidity and mortality.

Author's Contribution:

Concept & Design of Study:	Meher Afroze
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Conflict of Interest: The study has no conflict of interest to declare by any author.

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