Original paper

Incidence and Fate of Acute Kidney Injury in Patients Admitted to Pediatric Intensive Care unit

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Abstract

Background: Acute Kidney Injury (AKI) is a clinical condition that commonly occurs in critically ill patients in the pediatric intensive care unit (PICU) with mortality rate of between (30-44)%.
Objectives: The aims of this study were to determine the incidence and stages of AKI and the short-term clinical outcome in patients admitted to PICU of Babylon Teaching Hospital for Gynecology and Children.
Methods: This observational study involved 143 patients aging more than one month admitted to pediatric intensive care unit (PICU) of Babylon teaching hospital for gynecology and children over 1 year. For each patient, renal functions were assessed: measurement of serum creatinine and blood urea at time of admission then repeated every 24hours whenever indicated. Monitoring of the amount of urine output every hour.
We used classification system proposed by the Kidney Disease Improving Global outcomes (KDIGO) to define acute kidney injury stages
Results: Acute kidney injury occur in 45 patients (31%) of studied group while 98 patients (69%) were free from kidney injury.
Majority 27 patients (60%)) of total patient with Acute renal injury presented with stage 1.
10 patients (22%) presented with Stage 2 and 8 patients (18%) presented with stage 3.
Patients with AKI showed higher mortality (33.3) % compared with (22.4) % from patients without AKI.
Conclusion: AKI in critically ill children is found to have a high incidence and higher mortality.
Keywords: acute kidney injury, intensive care unit, Babylon.

Introduction

"Acute Kidney Injury (AKI) is a clinical condition that commonly occurs in critically ill patients in the pediatric intensive care unit (PICU) with mortality rate of between (30-44)% [1,2,3,4,5]."
Acute Kidney Injury was formerly refered to as acute renal failure due to the combination of limitation of blood supply together with hypoxia it affects kidney far prior to the increase in serum creatinine level [6].

"Acute Kidney Injury is a clinical syndrome characterized by reversible increase in the concentration of creatinine and nitrogenous waste products in the blood and the inability of the kidney to regulate fluid and electrolyte balance [7]."
It is an important and serious especially in children with critical illnesses of different diagnosis [8]. The discrimination between so pre-renal causes and renal causes of AKI is hardly possible, simply due to the fact that hypo-perfusion of the renal tissue may occur at any stage of AKI. That is to say, patients with renal hypo-perfusion may have AKI according to oliguria criteria without

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an obvious decrement in the glumerular filteration rate, GFR, especially when assessed by an elevated serum creatinine level [9].

Most updated classification for AKI was established by "acute dialysis quality initiative work group" that defines grades of increasing severity of AKI as R-risk, I-injury, F-failure, and two outcome classes (L for loss and E for end- stage renal failure) [10]. Hence called IFLE classification, the RIFLE criteria is regarded as a simple approach for detection and classification of AKI and for correlation with clinical outcome [11].

The incidence rate and predisposing factors of AKI in developing countries may be somewhat different compared to those in developed world, therefor generalization of findings of data from the developed countries to children in developing countries might lead to confounding conclusions. Data regarding the net incidence rate, risk factors and outcome of AKI could help in mounting strategies for prevention and treatments of AKI.

A classification system proposed by the Kidney Disease Improving Global outcomes (KDIGO) AKI Consensus Conference takes both serum creatinine and urine output criteria into account to define and stage AKI [12]

Aim of study

The aims of this study were to determine the incidence and stages of AKI and the short-term clinical outcome in patients admitted to PICU of Babylon Teaching Hospital for Gynecology and Children.

Patients and Methods

This observational study involved 156 patients, age group more than one month admitted to pediatric intensive care unit (PICU) of Babylon teaching hospital for gynecology and children, from March 2018 to March 2019. 13 patients of them were excluded because of presence of AKI before admission to PICU, the rest 143 patients were enrolled in the study.

Study settings

The following variables were included in the study for analysis: age, gender, length of stay, and stage of AKI.

For each patient, renal functions were assessed: measurement of serum creatinine and blood urea at time of admission then repeated every 24hrs whenever indicated. Monitoring of amount of urine output every hour.

Data Analysis

Statistical test was performed via SPSS application version 20. Non numerical variables were represented as % and frequencies. Pearson's chi square (X^2) was implicated to test the association between categorical parameters. A *p*-value equal or less than 0.05 was regarded as significant.

Results

Total admissions in the PICU during the year were 153, of them 13 patients of them were excluded because of presence of AKI before admission to PICU, the rest 143 patients were enrolled in the study.

Figure 1 shows the distribution of patients according to acute kidney injury. Acute kidney injury occur in 45 patients (31%) of study group while 98 patients (69%) were free from kidney injury.

Figure 2 shows the distribution of patients with acute kidney injury according to stage. Majority 27 patients (60%)) of total patient with Acute kidney injury presented with stage 1. Stage 2 10 patients (22%)) and stage 3 8 patients (18%)). (Total patients with renal injury 45).

Table one shows the distribution of patients according to the diagnosis, with a highest rate in patients complaining of congenital heart diseases.

Table two shows significant association between AKI and fate of patient.

Table three shows the association between stages of AKI and study variables including (age, gender, residence, duration of admission to PICU s and fate of patient) and significant association with fate of the patient.

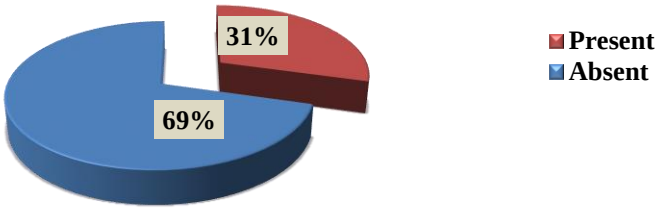

Figure 1. Distribution of patients according to acute kidney injury

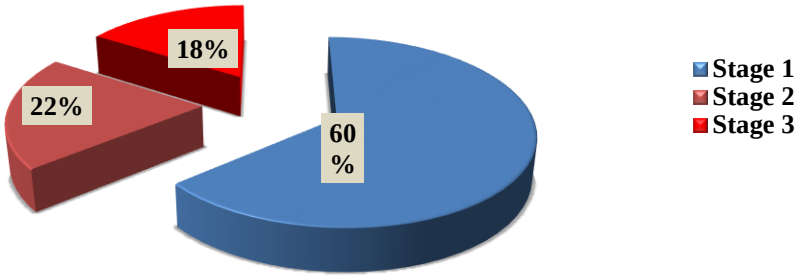

Figure 2. Distribution of patients with acute kidney injury according to stages

Table 1. Distribution of patients according to diagnosis

Diagnosis	AKI		No AKI	
Type Of Diagnosis	**No of patients**	**%**	**No of patients**	**%**
Sepsis	1	2.2	11	11.2
Pneumonia	9	20.0	16	16.3
Congenital Heart Disease	16	35.6	18	18.4
Werdnig Hoffmann Disease	1	2.2	11	11.2
Respiratory Distress Syndrom	0	0	1	1.0
Intracrenialheamorge	0	0	2	2.0
Encephalitis	3	6.7	11	11.2
Status Epilepticus	3	6.7	12	12.2
Surgary	3	6.7	3	3.1
Cerebral Palsy	2	4.4	1	1.0
Meningitis	1	2.2	3	3.1
Leukemia	0	0	3	3.1
Multipule Cong Anomalies	0	0	1	1.0
H1n1	0	0	1	1.0
Broncholitis	1	2.2	1	1.0
Chemical Poisining	0	0	1	1.0
Hydrocephally	0	0	1	1.0
Hepatoencephalopathy	0	0	3	3.1
Kerocin Poisining	0	0	1	1.0
Respiratory Fialure	0	0	1	1.0
Asthma	0	0	1	1.0
Muconium Aspiration	0	0	1	1.0
Miliary TB	0	0	1	1.0
Tetanus	1	2.2	0	0
Diabetic Ketoacidosis	2	4.4	0	0
Pneumothorax	1	2.2	0	0
Electrical Shock	1	2.2	0	0
Total	45	100.0	98	100.0

Table four shows the mean differences of serum creatinine (mg/dl) between patients with and without acute kidney injury. There were significant differences between means of serum creatinine by study groups.

Table five shows the mean differences of urine output (ml/kg/1hr) between patients with and without acute kidney injury. There were significant differences between means of urine output by study groups.

Table 2. Association between AKI and study variables including (age, gender, residence, duration of admission to PICU and fate of patient

	Study variables	AKI		No AKI		p. value
		No	**%**	**No**	**%**	0.842
Age	1-12 month	28	62.2	61	62.2	
	1 m - 5yr	11	24.4	28	28.6	
	More 5yr	6	13.3	9	9.2	
	Total	**45**	**100.0**	**98**	**100.0**	
Gender	Male	23	51.1	52	53.1	
	Female	22	48.9	46	46.9	0.723
	Total	45	100.0	98	100.0	
Residence	Urban	17	37.8	53	54.1	0.269
	Rural	28	62.2	45	45.9	
	Total	**45**	**100.0**	**98**	**100.0**	
duration of admission to PICU	less than 1day	6	13.3	12	12.2	0.619
	1-7 days	31	68.9	63	64.3	
	7days -1month	4	8.9	17	17.3	
	more than 1 month	4	8.9	6	6.1	
	Total	**45**	**100.0**	**98**	**100.0**	
Fate of patient	Life	30	66.7	76	77.6	
	Death	15	33.3	22	22.4	**<0.001***
	Total	**45**	**100.0**	**98**	**100.0**	

p value ≤ 0.05 was significant. f: fisher-exact test.

Table 3. Association between stages of AKI and study variables including (age, gender, residence, duration of admission to PICU s and fate of patient).

	Study variables	Stage 1		Stage 2		Stage 3		p.value
	Age group	**No**	**%**	**No**	**%**	No	%	0.500
Age	1-12m	15	55.6	6	60	6	75	
	1-5 yr	8	29.6	1	10	2	25	
	More 5 yr	4	14.8	3	30	0	0	
Total		**27**	**100.0**	**10**	**100.0**	**8**	**100.0**	
Gender	Male	10	37	8	80	5	62.5	0.714
	Female	17	63	2	20	3	37.5	
Total		27	100.0	10	100.0	8	100.0	
Residence	Urban	9	33.3	4	40	8	100	0.799
	Rural	18	66.7	6	60	0	0	
Total		27	100.0	10	100.0	8	100.0	
duration of admission to PICU	less than 1d	4	14.82	2	20	0	0	0.119
	1-7d	20	74.07	5	50	6	75	
	7d-1m	2	7.41	1	10	1	12.5	
	more than 1 m	1	3.7	2	20	1	12.5	
Total		27	100.0	10	100.0	8	100.0	
Fate of patient	Life	14	51.85	8	80	8	100	0.048
	Death	13	48.15	2	20	0	0	
Total		27	100.0	10	100.0	8	100.0	

*p value ≤ 0.05 was significant. f: fisher-exact test.

Table 4. Mean differences of study variables between serum creatinine between patients with and without acute kidney injury

Serum creatinine	ARI	N	Mean ± SD	Z	P value
Serum creatinine first reading (mg/dl)	Present	45	1.71 ± 1.45	**-5.227**	**<0.001***
	Absent	100	0.65 ± 0.2		
Serum creatinine second reading (mg/dl)	Present	45	2.29 ± 2.2	**-5.964**	**<0.001***
	Absent	100	0.63 ± 0.19		
Serum creatinine third reading (mg/dl)	Present	45	4.3 ± 2.36	**-5.924**	**<0.001***
	Absent	100	0.62 ± 0.21		

*P value ≤ 0.05 was significant.

Table 5. Mean differences of urine output between urine output between patients with and without acute kidney injury

Serum creatinine	ARI	N	Mean ± SD	Z	P value
Urine output after 6 hours (ml/kg/ 1hr)	Present	45	0.4± 0.51	**-4.123**	**<0.001***
	Absent	100	1.3±.06		
Urine output after 12 hours (ml/kg/ 1hr)	Present	45	0.38±0.92	**-3.792**	**<0.001***
	Absent	100	2.69 ± 0.59		
Urine output after 24 hours (ml/kg/1 hr)	Present	45	0.27 ± 0.35	**-3.431**	**0.001***
	Absent	100	2.15 ± 1.13		

*P value ≤ 0.05 was significant.

Discussion

In this study, the data has been analyzed from the admitted patients in the PICU by using (KDIGO) criteria [12] to diagnose AKI and estimation of the incidence of AKI and its association with mortality in PICU.

AKI is common among critically ill patients admitted to the intensive care unit (ICU) ranging from (4.5-70%) [1,13,14] .

the incidence of AKI was to 31% among critically ill children who were admitted to PICU during the period of study.

Sixty percent of patients with AKI develop stage one impairment which agree with study done by Williams et al were early AKI was present at PICU in (85)% [15].

Complicated congenital heart disease is a well-known risk factor for the development of AKI (35.6) % a figure corresponding to data done by Francesca De Zan et al (38.6) % [16].

The other prominent risk factor was pneumonia (20)% which approach a figure of (37)% found in recent study done by Mehta et al [17].

About the age of patients most common younger age group (1 mo.-12 mo.) laible to AKI in (62.2) % which corresponding to figure of a study from Taiwan found that AKI was a very common (56)% in lower age group [18].

Male patients are nearly equal to female patients but those from rural area show higher percentage (62.2) % than patients from the urban one which most probably because of delay in presentation and consultation of critical patients.

About the mortality rate our study show a high percentage (33.3) % from all AKI patients versus (22.4) % from patients without AKI which was agree with several studies have shown that AKI was associated with a significant increase in mortality [19,20,21].

There was a significant association between first, second, and third reading of serum creatinine with development of AKI and this consistent with Shweta Naik et al [22].

Also there was a significant association between urine outputs of the patients with AKI during (6-12-24) hour which consistent with many studies like that done by Wejdan al-jboor et al [23].

Limitations of the Study

Our study has some limitation, firstly the patients were not treated by RRT as they were hemodynamically unstable had increased bleeding tendency and rapid deterioration in there general condition. Secondly, our data based didn't include long term follow up and thus the outcomes for

patients following hospital discharge were unknown.

Recommendations

Further studies will be needed to find out AKI risk factors so as to find new strategies to prevent, decrease and treat AKI in critically ill children.

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