RESEARCH ARTICLE

Acute renal injury among seriously ill Iraqi children: risk factors, management, and outcome

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Abstract

Objective: To determine the frequency of acute kidney injury in seriously ill young patients, and to find out the risk factors linked to renal impairment.

Method: The cross-sectional study was conducted from June 1 to December 1, 2019, at the Central Child Teaching Hospital, Baghdad, Iraq, and comprised patients of either gender aged from >28 days to <18 years who presented to the emergency department with any critical acute illness who had to undergo hospitalisation. Kidney Disease Improving Global Outcomes criterion was used to identify patients having acute kidney injury. Such patients were followed up during their hospitalisation and their follow-up data was collected daily till discharge... Data was analysed using SPSS 25.

Results: of the 485 critically ill paediatric patients, 113(23.3%) had acute kidney injury; 57(50.9%) females and 56(49.1%) males. The overall mean age was 18.68±25.8 months (range: 1.5-120 months). There were 46(40.7%) patients with stage 3 disease. The incidence of acute kidney disease was not significantly associated with either age or gender (p>0.05). Diarrhoea and vomiting were the only complaints that had a significant association with acute kidney injury (p=0.001). Sagwa was consumed by 40(8.2%) cases, and 35(87.5%) of them developed acute kidney injury (p=0.001). Ventilator was used in 12(10.6%) cases, Of the total 65(13.4) cases of mortality, 21(18.6%) had acute kidney injury compared to 44(11.8%) of the rest (p=0.014).

Conclusion: Acute renal impairment was found to be prevalent in seriously ill paediatric patients and was linked to increased mortality. Sagwa poisoning, diarrhoea and vomiting as presenting complaints had a significant association with acute kidney disease in such patients.

Key Words: Critical Illness, Acute Disease, Incidence, Kidney Injury, Ventilators, Diarrhea, Vomiting

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Introduction

Critical illness in the paediatric age group is defined as any serious condition affecting the airways, respiration or circulation, or acute decline of consciousness. Such children are usually presented to health facilities with different acute signs.[1] Paediatric patients with critical illness commonly develop acute kidney injury (AKI) with its deleterious consequences in increasing the mortality of critically ill children.[2] The incidence of AKI depends on the patient's clinical condition, varying from 5% in hospitalised children to 25% in critically ill paediatric patients.[3]

More than 10 risk factors for renal impairment were reported in a study of seriously ill children. Age, unscheduled admission to intensive care unit (ICU), admission type, admission diagnoses, the score of mortality risk, and use of nephrotoxic medication were all related to disease severity (organ dysfunction) or therapeutic intervention (intravenous [IV] contrast, extracorporeal membrane oxygenation, and nephrotoxic medication). The administration of nephrotoxic medicines was the single biggest risk factor for AKI.[4]

AKI is described as an acute decline in renal function, causing glomerular filtration rate (GFR) to drop quickly with subsequent build-up of waste products.[1] The Kidney Disease Improving Global Outcomes (KDIGO) criteria have been used to standardise AKI classification into three stages based on the degree of increased creatinine and decreased urine output, with stage 3 indicating severe AKI, with patients even needing renal replacement therapy.[5]

To our knowledge, no prior study on AKI in seriously ill children has been conducted in Iraq. The current study was planned to fill the gap by determining AKI incidence in critically ill children, and to find out the risk factors linked to renal impairment.

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Patients and Methods

The cross-sectional study was conducted from June 1 to December 1, 2019, at the Central Child Teaching Hospital, Baghdad, Iraq. After approval from the ethics review committee of the College of Medicine, Mustansiriyah University, Baghdad, Iraq, the sample was raised using simple randomisation sampling technique, and all critically ill patients admitted to the emergency department (ED) who met the inclusion criteria were recruited. Written informed consent was obtained from parents/guardians of the patients.

Those included were patients of either gender aged from >28 days to <18 years who presented to ED with any critical acute illness for which they had to undergo hospitalisation. Critical illness was defined as patient having respiratory symptoms (obstructed breathing, central cyanosis, severe respiratory distress), severely impaired circulation, and neurological symptoms, like disturbed level of consciousness, seizure and coma.[2]

Patients with chronic renal, cardiac or other medical conditions, any congenital syndrome or anomaly, post-operative patients, and those lost to follow-up were excluded.

Detailed history was taken from the parents along with patient's age, gender and presenting symptoms. Each patient was subjected to a thorough physical examination. Although all patients included needed paediatric intensive care unit (PICU) admission, not all of them were admitted because of the limited number of beds available. Those who were not admitted to PICU were taken care of in ED till stabilisation and then admitted to different paediatric wards.

The patients were followed up during their hospitalisation whether in ED, wards, or PICU, and their follow-up data was collected daily.

The KDIGO criterion was used to identify patients with AKI (5). For patients with AKI, urinary output, blood urea and serum creatinine levels were documented on a daily bases. Patients were followed up till their discharge. Data was collected about the type of intervention, duration of hospital stay and final outcome.

Data was analysed using SPSS 25. Data was expressed using frequencies, percentages, mean and standard deviation, as appropriate. P<0.05 was taken as significant.

Results

Of the 943 patients presenting to ED during the study period, 485(51.43%) were recruited. Of them, 113(23.3%) had AKI (Figure); 57(50.9%) females and 56(49.1%) males.

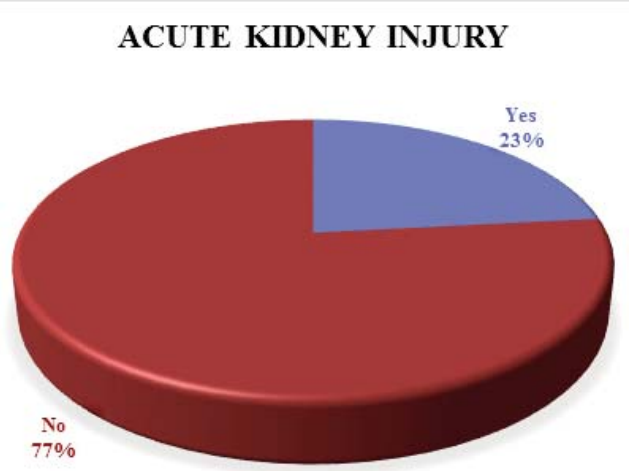

Figure: Incidence of acute kidney injury (AKI) in critically ill children.

Table-1: Demographical and clinical characteristics.

Variables	Acute Kidney Injury			
	Yes (%) n= 113	No (%) n= 372	Total (%) n= 485	P Value
Age group				
Infant	83 (25.4)	244 (74.6)	327 (67.4)	0.123
Toddler	11 (13.3)	72 (86.7)	83 (17.1)	
Preschool age	10 (27.0)	27 (73.0)	37 (7.6)	
School age	9 (23.7)	29 (76.3)	38 (7.8)	
Gender				
Male	57 (23.1)	190 (76.9)	247 (50.9)	0.906
Female	56 (23.5)	182 (76.5)	238 (49.1)	
Chief complaint				
Shortness of breath	27 (17.3)	129 (82.7)	156 (32.2)	0.001
Poor Feeding	7 (9.6)	66 (90.4)	73 (15.1)	
Disturbed level of consciousness	8 (11.8)	60 (88.2)	68 (14.0)	
Lethargy	24 (42.9)	32 (57.1)	56 (11.5)	
Neurological signs (Seizure)	9 (22.5)	31 (77.5)	40 (8.2)	
Diarrhoea and/or vomiting	29 (82.9)	6 (17.1)	35 (7.2)	
Apnoea and/or cyanosis	4 (12.5)	28 (87.5)	32 (6.6)	
Others	5 (20.0)	20 (80.0)	25 (5.2)	
Primary disease				
Chest infection	20 (10.4)	173(89.6)	193 (39.8)	0.001
Gastroenteritis	34 (50.0)	34 (50.0)	68 (14.0)	
CNS infection	9 (12.0)	66(88.0)	75 (15.5)	
Diabetic ketoacidosis	2 (8.7)	21 (91.3)	23 (4.7)	
Sagwa poisoning*	35 (87.5)	5 (12.5)	40 (8.2)	
Sepsis	9 (25.0)	27 (75.0)	36 (7.4)	
Poisoning	0 (0)	9 (100.0)	9 (1.9)	
Haemato-oncology disorders	2(14.3)	12(85.7)	14 (2.8)	
Others**	2 (7.4)	25 (92.6)	27 (5.6)	

* Sagwa: Unknown herbal and other contents prepared by certain individuals in Iraqi society.
**Anaphylactic shock, Metabolic disease, Hepatic failure, Dilated cardiomyopathy, Electrical shock, Demyelinating central nervous system (CNS) diseases, gastrointestinal (GI) bleeding.

The overall mean age was 18.68±25.8 months (range: 1.5-120 months). AKI incidence was not significantly associated with either age or gender (p>0.05). Diarrhoea

Table-2: Distribution of patients with acute kidney injury (AKI) by type of treatment, need for ventilation support and KDIGO stage..

Treatment of AKI	No. (n= 113)	Percentage (%)
Type		
Medical	69	61.0
Peritoneal dialysis	42	37.2
Haemodialysis	2	1.8
Ventilator use		
Yes	12	10.6
No	101	89.4
KDIGO score stage		
Stage 1	34	30
Stage 2	33	29.3
Stage 3	46	40.7

KIDGO: Kidney Disease Improving Global Outcomes.

and vomiting were the only complaints that had a significant association with AKI (p=0.001). Sagwa, a herbal concoction prepared by certain individuals in Iraqi society mostly for gastrointestinal (GI) discomfort, was consumed by 40(8.2%) cases, and 35(87.5%) of them developed AKI (p=0.001) (Table 1). There were 46(40.7%) patients with KIDGO stage 3 disease, and ventilator was used in 12(10.6%) cases (Table 2).

Of the total 65(13.4) cases of mortality, 21(18.6%) had AKI compared to 44(11.8%) of the rest (p=0.014).

Discussion

Worldwide, AKI represents a growing concern for healthcare providers as its incidence is increasing along with its adverse outcomes.[6,7] In seriously ill paediatric patients, AKI is a common problem and can be seen at different rates, ranging from 0.3% to 80% depending on the studied population,[8]. Although the incidence of AKI in critically ill children has not been studied in Iraq, studies from other countries show that the incidence of AKI is high, with an associated increased length of stay and risk of mortality in critically ill children.[9]

The frequency of AKI in seriously ill children was 23.3% in the current study. This rate is similar to results reported in literature (24.8%, 23.7% and 27.4%).[4,10,11] The highest rate was reported to be 82%.[12]

In the present study, no significant association was found between AKI incidence with age and gender of the patients, which is consistent with a study.[4]

Regarding chief complaints, 82.9% of patients who presented with diarrhoea and/or vomiting had AKI (p=0.001), which agrees with an earlier study.[13]

Malalla et al.[14] reported decreased urine output as the most common presenting symptom in the AKI study group (45%), while Salih et al.[15] reported acidotic breathing (80%). The difference is attributable to the difference in the inclusion criteria of different studies.

In the current study, Sagwa poisoning was the only primary disease that was significantly associated with renal impairment (p=0.001). In a study, sepsis was the most common primary disease in AKI patients.[11] Pneumonia was the main primary disease diagnosed in another study.[12] Although intoxication was reported as a primary disease in 0.9% of AKI cases in a study[11], Sagwa was not reported as a primary disease. Sagwa is a herbal remedy widely used by families in rural areas of Iraq for the treatment of GI discomfort due to widespread poverty and low levels of education in such areas. These herbs contain cadmium, mercury, lead and other unknown substances that have a deleterious effect and can result in arrhythmia, acute renal failure, and neurological complications.[15]

Regarding Aki stage in the current study, KIDGO stage 3 was predominant (40.7%). Previous studies[10,12,13] reported stage 1 to be the most prevalent. This difference can be attributed to the fact that the site of the current study happened to be a tertiary hospital receiving referred cases from other hospitals for peritoneal dialysis (PD) after lack of response to medical conservative treatment in other hospitals.

In the current study, medical treatment was the predominant modality (61%), followed by PD (37.2%) and haemodialysis (HD) (1.8%). The finding agrees with Salih et al. who reported medical treatment (80.8%) and PD (19.1%).[14] On the other hand, 2 studies reported higher use of PD (65.6% and 40.5%) in AKI patients.[9,15]

The similarity of the results with Salih et al.[14] came from the fact that both studies were conducted in the same settings. The majority of medical treatment in both studies was due to family refusal of the PD procedure and/or patients who were not fit for PD. The difference in PD-related results between the current study and the other studies[9,15] is that most of the patients in the current study were KDIGO stage 3 and received treatment when there was no response to medical treatment in other hospitals, and also because the Central Child Teaching Hospital is considered a dialysis centre.

A mechanical ventilator was used only in 10.6% of critically ill children in the current study, which is lower than 47.7%, 65.2%, and 75.3% reported earlier.[10,11,16] The finding is rather misleading because the majority of the AKI patients in the current study required PICU admission

and mechanical ventilation, but the institutional PICU had only 4 beds, and the majority of the patients had to be managed in ED and Nephrology wards.

In the current study, the mortality rate was higher in the AKI group than in the non-AKI group (18.6% vs 11.6%; p=0.014). This agrees with a study in Brazil which identified a 10-fold mortality rate in patients with any stage of AKI[16]. Also, Akcan-Arikan et al. reported higher mortality in AKI patients than in patients with no renal function impairment.[12].

Limitation: The current study has several limitations. It was done at a single centre, and the findings not be representative of the whole country. Also, the sample size was not calculated which could have caused a decrease in the power. Besides, it was carried out at a hospital which is regarded as a dialysis centre, and dialysis was not available in many paediatric hospitals in Iraq. Finally, the paucity of PICU beds led to under usage of ventilators for critically ill children.

Conclusion

AKI was found to be prevalent in critically ill paediatric patients, and it was linked to a higher fatality rate. Sagwa poisoning, diarrhoea and vomiting had significant associations with AKI in critically ill children.

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