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Hospital outcome of Children with Acute Kidney Injury in a Tertiary Care Hospital

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Abstract **Original Research Article**

Introduction: Acute Kidney Injury (AKI), formerly known as Acute Renal Failure, is characterized by a reversible increase in creatinine and nitrogenous waste product concentrations in the blood, as well as the kidney's failure to maintain proper fluid and electrolyte balance. Whether the etiology of AKI varies by area, the incidence of AKI in children appears to be increasing. The etiology of AKI in hospitalized children has shifted from primary renal disease to various causes during the last several decades, particularly in hospitalized children. As a result, further study is needed to determine the most recent trends in AKI in this region. Because it is still connected with significance. ***Aim of the study:*** The aim of the study was to observe the hospital outcome of hospitalized acute kidney injury children**.** ***Methods:*** This prospective longitudinal study was performed in the Department of Pediatrics, Dhaka Shishu Hospital, Dhaka, during the period of 12 months from January 2015 to December 2015. A total of 50 children were selected from the ones admitted into the hospital following the inclusion and exclusion criteria. A detailed history was taken, thorough physical examination and relevant laboratory investigations were done in all enrolled patients. All underwent necessary supportive care as needed until discharge or death ($p<0.01$). ***Result:*** The mean age of the children was 2.8 ± 1.9 years, with the youngest one being 4 days and the oldest, 12.5 years. Male: female ratio was 1.8:1. Children in the age group of 1-5 years were most commonly affected. Pre-renal cause was the most common cause of acute kidney injury, present in 64% of the cases. 62% had complete recovery by hospital discharge, and 22% died. The most common cause of death was multi-organ failure and was statistically significant ($p<0.01$). At 6-month follow up, 4 patients had chronic kidney disease and 2 patients died**.** ***Conclusion:*** It was observed that, AKI was more common in early childhood (less than 5 years) than more than 5 years because of high incidence of diarrhea. The higher mortality rate was due to multi-organ failure.

Keywords: Chronic Kidney Disease, Kidney, Renal, Dialysis.

INTRODUCTION

Acute Kidney Injury (AKI) is common in poor countries like Bangladesh. AKI is typically defined as a significant decrease in glomerular filtration rate, which results in an increase in serum creatinine. Because an increase in creatinine can occur up to 48 hours after kidney damage, it is essential to recognize the limitations of creatinine as a marker of AKI. Despite this limitation, creatinine change is still the gold standard for detecting AKI. The epidemiology of AKI has evolved over time and currently reflects the patient population being studied. The most common causes of AKI in developing countries continue to be volume depletion, infection, and primary renal diseases (hemolytic uremic syndrome, glomerulonephritis). AKI in previously healthy children in rich countries is still mostly caused by volume depletion and primary renal dysfunction. The etiology of AKI in hospitalized children in developed countries, particularly in tertiary care institutions, has changed from primary renal disease to secondary causes of AKI, which are usually complicated in nature and frequently complicate another diagnosis or its treatment [1]. In an 8-year study of pediatric patients at a tertiary care facility, 227 children got dialysis, with an overall incidence of 0.8 per 100,000 total population [2]. For children who develop AKI, a comprehensive history and physical examination are important. Quantifying urine production during the previous few days may offer insight into the origin and severity of the AKI episode and serves to classify the event as oliguric (defined as

urine output of 1mL/kg/h) or non oliguric [3]. The development of treatment criteria in AKI is hampered by the disease's complex etiology and a scarcity of prospectively verified data. As a result, although being generally centered on preventing future damage, patient treatment is extremely diverse. Attempts are made to regulate renal perfusion pressure and optimize renal preload in order to limit ischemia damage. Patients who have been shocked should get an intravenous fluid bolus of 20 ml/kg right away. If the reaction is inadequate, a second intravenous bolus of 20 ml/kg should be administered. Once the volume is determined, it is directed by the patient's fluid status, urine output, and additional renal fluid losses. A global project aimed at eliminating avoidable fatalities from AKI globally by 2025, with a special emphasis on poor nations in Africa and Asia. The objective is to advocate for universally applicable techniques that allow for the prompt identification and treatment of AKI in individuals with potentially reversible illnesses in order to attain this lofty goal. AKI is frequently avoidable and curable, with few, if any, long-term health effects. However, due to a lack of early detection and treatment in many countries, patients frequently do not obtain necessary care until it is too late. Acute alterations in kidney function are linked to long-term repercussions such as progression to chronic renal disease, cardiovascular effects, long-term functional disability, and mortality [4]. Long-term outcomes in AKI survivors have become a major area of interest, with a burgeoning number of studies reporting links between AKI and the development or progression of CKD, longer-term mortality, cardiovascular events, hospital readmissions, recurrent AKI, and overall poorer quality of life [5-10]. It has been observed that many AKI survivors face higher mortality rates and other ailments later in life [5, 7]. The present study was conducted to observe the hospital outcomes of the pediatric AKI patients and underlying causes of mortality and morbidity.

OBJECTIVE

General Objective

- To observe the hospital outcome of children with AKI in a tertiary care hospital.

METHODS

This prospective longitudinal study was conducted at the Department of Paediatrics, Dhaka Shishu Hospital, Dhaka. Bangladesh. The study duration was one year, starting from January 2015 to December 2015. Initially, the sample size was estimated to be 32 according to the mathematical formula. But in order to increase the validity of the study, the sample size was finalized to be 50. The participants were selected through a convenient sampling method among the children having evidence of kidney injury admitted into the study hospital. Each patient had undergone detailed clinical evaluation and relevant laboratory investigations. Clinical data of each patient was collected in a preformed data collection sheet. A follow-up was performed 6-month after the hospital discharge of surviving patients. A detailed history was taken regarding each patient. Informed written consent was obtained from the legal guardian of the participants, and ethical approval was obtained from the ethical review committee of the hospital. Statistical analysis was performed using the statistical package for social science for windows SPSS version 16 by descript statistics. P value <0.05 considered statistically significant.

Inclusion Criteria

- Children under the age of 15
- Patients fulfilling the definition of acute kidney injury
- Patients who had given consent to participate in the study.

Exclusion Criteria

- Mentally ill.
- Unable to answer the criteria question.
- Children with acute on chronic kidney disease
- End-stage renal disease

RESULTS

In the present study, the mean age of the children was 2.8 ± 1.9 years, with the youngest one being 4 days and the oldest, 12.5 years. Male: female ratio was 1.8:1. Children in the age group of 1-5 years were most commonly affected. Pre-renal cause was the most common cause of acute kidney injury, present in 64% of the cases. 62% had complete recovery by hospital discharge, and 22% died. The most common cause of death was multi-organ failure which was statistically significant (p<0.01). At 6-month follow up, 4 patients had chronic kidney disease and 2 patients died.

Table 1: Age distribution of the participants (n=50)

Age in years	N	%
<1 month	7	14
1 month - 1 year	14	28
>1 - 5 years	17	34
>5 years	12	24
Total	50	100
Mean age	2.8 ±1.9 years	
Range	4 days – 12.5 years	

Very few children (24%) were older than 5 years of age. 34% of the children belonged to the age group of 1 to 5 years. 28% of the participants were from the age group of 1 month to 1 year, and 14% were less than 1 month of age. The mean age of the participants was 2.8±1.9 years, and the age range of the participants was 4 days to 12.5 years.

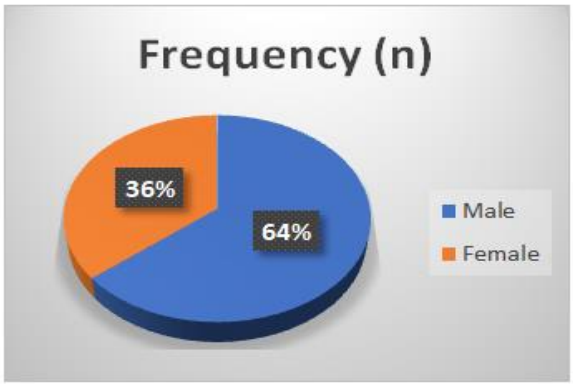

Figure 1: Gender distribution of the participants (n=50)

Among the children, about two-thirds were male (64%), and the remaining one–third (36%) were female. Male: female ratio was 1.8:1.

Table 2: Causes of AKI among the participants (n=50)

AKI Causes	N	%
Pre-renal	32	64
Renal	13	26
Post Renal	5	10

Among the participants, 64% had pre-renal types of acute kidney injury, 26% had renal type of kidney injury, and the remaining 10% had post renal type of AKI.

Table 3: Mode of treatment of the participants (n=50)

Mode of treatment	Cases	Survivor	Death
Conservative management	30 (60%)	25 (83.3%)	5 (16.7%)
Peritoneal dialysis	19 (38%)	13 (68.4%)	6 (31.6%)
Surgery	1 (2%)	1 (100%)	0

The 50 participants had primarily gone through three modes of treatment. 60% of the participants went through conservative management, 38% went through peritoneal dialysis, and the remaining 1 participant went through surgery. Among the conservative management participants, 83.3% survived and 16.7% died. Among the peritoneal dialysis patients, the survival rate was 68.4%. The participant who had to go through surgery also survived.

Table 4: Hospital outcome of the participants (n=50)

Outcome	N	%
Complete recovery	31	62
Discharge with morbidity	6	12
Death	11	22
Left Therapy	2	4

62% of the participants showed complete recovery at hospital discharge. 12% of the participants got discharged on request after improvement of clinical and laboratory parameters, but were not fully cured. 4% of the participants had to leave the treatment due to financial constraints, while the mortality rate was 22%.

Table 5: Comparison of Survivor and dead in children with AKI

Parameter	Outcome of patients		P value
	Survivor (n=39)	Dead (n=11)	
Age <5 years	29 (74.4%)	9 (81.8)	0.14
Male	23 (58.9%)	8 (72.7%)	0.07
Overwhelming sepsis	11 (28%)	3 (27.3%)	0.71
Hypovolemic shock	13 (31%)	2 (18.1%)	0.12
dyselectrolytemia	24 (61.5%)	2 (18.1%)	0.81
Severe PNA Per natal asphyxia	4 (10.3%)	2 (18.1%)	0.45
Pneumonia	6 (15.8%)	1 (9%)	0.36
CHF (Congestive heart Failure)	3 (8%)	1 (9%)	0.89
Multi organ failure	0	3(27.3%)	0.01
Renal Replacement therapy (RRT)	13 (31%)	6 (40%)	0.18

Table 5 shown the comparison of survivor and dead in children with AKI where survivor of Age <5 years 29 (74.4%), Overwhelming sepsis 11 (28%), Hypovolemic shock 13 (31%), dyselectrolytemia 24 (61.5%), Severe PNA Per natal asphyxia 4 (10.3%), Pneumonia 6 (15.8%), CHF (Congestive heart Failure) 3 (8%), Multi organ failure 0, Renal Replacement therapy (RRT) 13 (31%) and dead of the same parameter was 9 (81.8), 3 (27.3%), 2 (18.1%), 2 (18.1%), 2 (18.1%), 1 (9%), 1 (9%), 3, 6 (40%) found respectively.

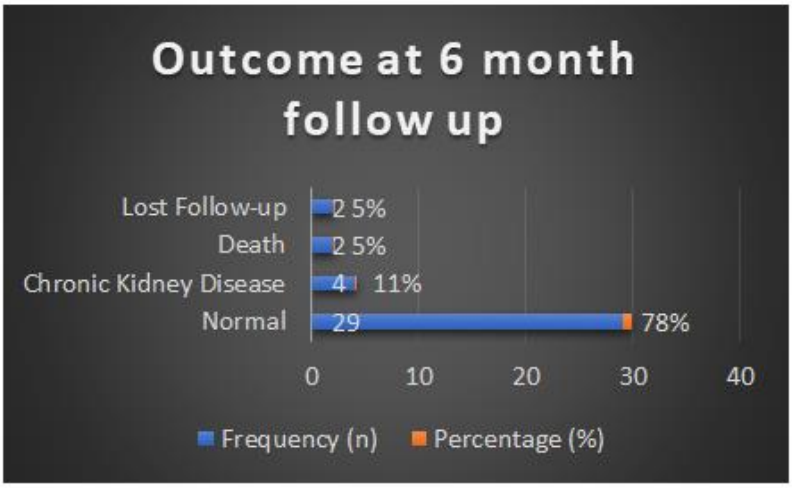

Figure 2: Patient outcome at 6-month follow up (n=37)

At the 6-month follow up, 78% of the 37 participants showed normal conditions, while 11% had developed chronic kidney disease. 2 of the participants were lost for the follow-up, and the remaining 2 participants had died during the 6-month period of hospital discharge.

DISCUSSION

Acute Kidney Damage (AKI) is a worldwide public health issue with significant morbidity, death, and healthcare expenditures. Aside from dialysis, no other treatment increases survival, reduces damage, or speeds up recovery [11]. It was formerly thought that such patients had a low risk of late sequelae, but several recent studies have revealed that chronic kidney disease can develop following AKI [12, 13]. The age distribution of the children in the current study was determined to be 76 percent under the age of five and 24 percent above the age of five. The ages of the participants varied from 4 days to 12.5 years. The average age of the youngsters was 2.81.9 years. Sixty-four percent of the study's participants were men, while three-sixths were women. There was a male-to-female ratio of 1.8:1. Because of a number of etiological and geographical factors, the age distribution of AKI patients differs from study to study [14]. Srivastava's study, which was comparable to ours, discovered that children aged 1-4 years had the highest frequency of AKI [15]. Sixty-four percent of the current research participants had pre-renal AKI, 26 percent had renal AKI, and ten percent had post-renal AKI. The high incidence of prerenal causes of AKI contrasted with several worldwide investigations, which found a greater prevalence of renal causes [16]. In terms of treatment modality, 60% of the participants went through conservative management, while 38% went through peritoneal dialysis, and the remaining 1 participant went through surgery. 62% of the participants showed complete recovery at hospital discharge. 12% of the participants got discharged on request after improvement of clinical and laboratory parameters, but were not fully cured. 4% of the participants had to leave the treatment due to financial constraints, while the mortality rate was 22%. In total, 11 of the 50 participants died during their hospital stay. 5 of the mortality cases went through conservative management, while the remaining 6 cases of mortality went through peritoneal dialysis as a method of treatment. When observing the cause of death of the 11 participants who died during hospital stay, the most common complications present were sepsis and multi-organ failure. 1 participant had congestive heart failure as a cause of death. A follow-up was performed 6-month after the hospital discharge of each available patients. During the follow-up of the 37 cases, it was observed that 78% had normal physical health, while 4 cases developed chronic kidney disease (CKD). 2 participants were lost during the follow-up, and the remaining 2 participants died during the 6-month period after discharge, the 4 cases of CKD and the 2 cases of death all belonged the cases where the participants were discharged without complete recovery due to personal problem. Overall, the present study had a mortality rate of 26%, including the deaths during follow-up. This mortality rate was lower compared to other studies [17, 18]. Van Biljon discovered a greater incidence and duration of anuria among non-survivors with AKI in research similar to this one [19]. Afroz S *et al*., found that 4% of patients had CKD after three months, whereas 11% of patients developed CKD in our research [20]. After three months of follow-up, Shaheen IS et al. discovered 8% CKD [21].

Limitations of the Study

The study was conducted in a single hospital with small sample size. So, the results may not represent the whole community. The study design was not experimental, and prognostic factors were not properly evaluated.

Funding: No funding sources.

Conflict of interest: None declared.

Ethical approval: The study was approved by the Institutional Ethics Committee.

CONCLUSION

It was observed that, AKI was more common in early childhood (less than 5 years) than more than 5 years because of high incidence of diarrhea. The higher mortality rate was due to multi-organ failure and overwhelming sepsis. Majority of survived patients had complete recovery (78%), 11% progressed to chronic kidney disease. Overall mortality was 26%.

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