Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Paediatric Cardiology

Clinical Profile of Children with Acute Kidney Injury in a Tertiary Care Hospital, Dhaka, Bangladesh

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DOI: 10.36347/sjams.2021.v09i11.023 | **Received:** 20.09.2021 | **Accepted:** 29.10.2021 | **Published:** 30.11.2021

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Abstract **Original Research Article**

Introduction: Acute Kidney Injury (AKI), formerly known as Acute Renal Failure, is defined by a reversible rise in creatinine and nitrogenous waste product concentrations in the blood, as well as the kidney's inability to control fluid and electrolyte balance correctly. Whether the cause of AKI differs in different regions of the world, the incidence of AKI in children appears to be growing. Over the last several decades, the etiology of AKI in hospitalized children has changed from primary renal disease to multiple reasons, particularly in hospitalized children. As a result, research is required to identify the most current trends in AKI in this region. Because it continues to be associated with significant mortality and morbidity in poor nations with inadequate resources, including renal replacement treatment. ***Aim of the study:*** The aim of the study was to observe the clinical profiles 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. ***Result:*** 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. The most common clinical feature was oliguria 88%. Diarrhea and peripheral edema were other common presenting complaints. Etiology of AKI was mainly pre-renal 64%, followed by renal 26% and post-renal 10% causes. The overall mortality rate was 22%. ***Conclusion:*** It was observed that AKI was more common in early childhood (less than 5 years) than in more than 5 years. The most common clinical manifestation was Oliguria. The majority of the cases had pre-renal causes, and stage 2 AKI was the least common type of acute kidney injury. The majority of survived patients had complete recovery, with few mortalities.

Keywords: Kidney, Renal, Kidney Failure, Children.

INTRODUCTION

The kidney is a highly vascular organ that is susceptible to ischemia damage when blood flow to it is reduced. It is especially vulnerable to nephrotoxic damage due to its abundant blood supply and propensity to concentrate toxins in the medullary interstitium and renal epithelial cells [1]. Acute Kidney Injury (AKI), formerly known as Acute Renal Failure, is defined by a reversible rise in the blood levels of creatinine and nitrogenous waste product, as well as the kidney's failure to manage fluid and electrolyte balance appropriately [2]. It is critical to understand the limits of creatinine as a measure of AKI since a rise in creatinine can occur up to 48 hours after kidney injury has occurred. Despite this restriction, creatinine change remains the gold standard for diagnosing AKI. The frequency of AKI in children appears to be increasing: the etiology of AKI in hospitalized children, in particular, has changed from primary renal disease to multifactorial reasons during the last decades, particularly in hospitalized children [3]. A recent survey from Thailand has shown an almost nine-fold increase in the incidence of AKI among PICU children over the last 22 years [3]. AKI is more common in older children admitted to intensive care units with multiple co-morbidities and multi-organ failure in developed countries, whereas in developing countries, documented

single disease entities such as diarrheal diseases, malaria, hemolytic uremic syndrome, and acute glomerulonephritis are still the major causes of AKI [4]. Acute Kidney Injury is one of the most prevalent life-threatening illnesses in children. It has a major impact on morbidity and mortality in children. The short-term prognosis of AKI therapy is greatly reliant on the underlying cause, the status of the other organs, and the availability of renal replacement therapy [5]. It has been observed that in cases with multi-organ failure, mortality and morbidity rates are much higher [6]. Conservative treatment, such as thorough monitoring of daily urine and other outputs and cautious restoration of calorie, fluid, and electrolyte deficits, is essential for the effectiveness of AKI management at first [7]. Furthermore, due to the availability of dialysis facilities and competent supportive care, peritoneal dialysis (PD) has become the dialysis therapy of choice in young children [8]. Dialysis, particularly hemodialysis, is a difficult prospect for children in facilities with insufficient resources and poor competence. Despite technological advancements in renal replacement treatment and supportive care over the last several decades, the death rate of these patients remains high due to limited access to dialysis in underdeveloped nations [9]. In most developing and underdeveloped countries, including Bangladesh, the in-hospital mortality rate, including PICU/NICU, varies from 25.5% to 50.8% [10]. Very limited studies are available on the clinical profile and outcome of AKI in children in Bangladesh. So, the aim of this study was to assess the overall clinical profile and hospital outcome of Acute Kidney Injury patients and their outcome.

OBJECTIVE

General Objective

- To see the clinical presentation in hospitalized AKI children
- To observe the hospital outcome of children with AKI.

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 detail clinical evaluation and relevant laboratory investigations. Clinical data of each patient was collected in a preformed data collection sheet. 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.

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

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.

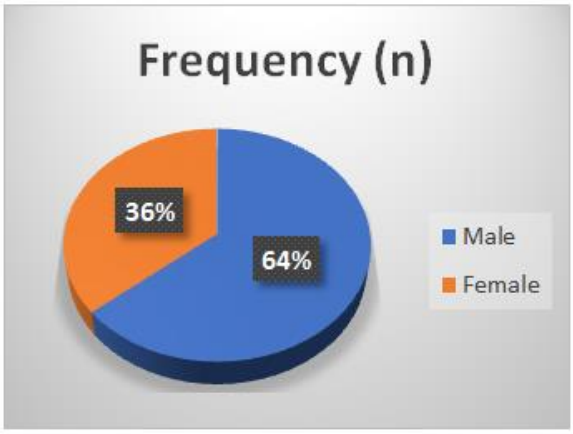

Figure 1: Gender distribution of the participants (n=50)

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: Clinical presentations of the participants (n=50)

Clinical Features	N	%
Oliguria	44	88
Diarrhea	20	40
Peripheral oedema	12	24
Fever	11	22
Anemia	11	22
Ascites	8	16
Vomiting	8	16
Hematuria	7	14
Respiratory distress	7	14
Shock	6	12
Rash	5	10
Anuria	4	8
Headache	4	8
Hypertension	4	8
Seizures	3	6
Jaundice	3	6

The most common clinical presentation was Oliguria, defined by the urinary output of less than 1 ml/kg/hour. Oliguria was present in 88% of the participants, followed by diarrhea, present in 40% of the participants. Peripheral edema, or the swelling of lower legs and hands, was observed in 24% of the cases. Fever and Anemia were present in 22% of cases each. Similarly, ascites and vomiting were each present in 16% of cases, hematuria, respiratory distress, shock, rash, anuria, headache, hypertension, seizures, and jaundice were also present as clinical manifestations in smaller amounts among the participants.

Table 3: 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 4: Stages of AKI among the participants (n=50)

AKI Stages	N	%
Stage 1	20	40
Stage 2	14	28
Stage 3	16	32

According to the Acute Kidney Injury Network (AKIN) classification, 40% of patients were in stage 1, 28% of patients were in stage 2 and 32% of patients were in stage 3.

Table 5: Laboratory parameters of the participants during hospital stay (n=50)

Test	Mean	SD
Serum urea (mmol/L)	21	10.2
Serum Sodium (mmol/L)	129.3	6
Serum Potassium (mmol/L)	4.4	0.9
Serum Bicarbonate (mmol/L)	16.4	1.4
Serum Calcium (mmol/L)	1.5	0.3
Serum Phosphate (mmol/L)	1.7	0.4
Blood pH (mm Hg)	7.2	0.9
Urinary Na (mmol/L)	114.7	26.1
Urinary Creatinine (mg/dl)	4.03	2.81
eGFR at admission (ml/min/1.73m^2)	192.6	126.4

Mean serum creatinine was at presentation, which was higher than normal levels for children. Serum Sodium was low, mean of 129.3±6 (SD) mmol/L. Blood pH was mostly acidic 7.2±0.9 (SD) mm Hg. Serum creatinine was 4.03±2.81 mg/dl.

Table 6: 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 patients had complete resolution of signs and symptoms and laboratory parameters returned to a normal level. 22% of patients died during the hospital stay. 12% of the patients got discharged on request after improvement of clinical and laboratory parameters but were not fully cured. Two of the patients (4%) left therapy on risk bond due to financial constrain.

DISCUSSION

Apart from dialysis, no treatment intervention improves survival, limits damage, or speeds recovery [11]. Acute kidney injury can have many causes, like hypertension, decreased blood flow, organ failure, external damage to the kidneys, blockage of urinary tracts, and many others. Volume depletion and primary renal disease continue to be major causes of AKI in previously healthy children in affluent nations. In hospitalized children in industrialized nations, particularly in tertiary care facilities, the etiology of

AKI has shifted from primary renal illness to secondary causes of AKI, which are frequently complex in character and frequently complicate another diagnosis or its treatment [12]. In individuals with pre-existing chronic kidney disease, any of these causes, particularly volume depletion, may produce acute kidney damage in addition to chronic renal function impairment [2]. Prerenal causes are responsible for approximately 70% of community-acquired instances of acute kidney damage [13]. In the current study, the age distribution of the children was observed to be 76 % under the age of five and 24 % above the age of five. The minimum age was 4 days, and the maximum age was 12.5 years among the participants. The children's average age was 2.8±1.9 years. 64% of the research participants were male, while 36% were female. The male-to-female ratio was 1.8:1. The age distribution of AKI participants varies from study to study, due to various etiological and geographical factors [14]. Similar to our study, a study by Srivastava reported the highest incidence of AKI among the participants aged between 1-4 years [15]. Another study, however, showed contradictory results with a majority of participants being of 9-12 years of age [16]. Among the presenting clinical features, Oliguria was the most common, present in 88% of the cases. This high prevalence of Oliguria was similar to the findings of multiple studies [14, 17, 18]. Diarrhea, peripheral edema, fever, and anemia were some of the other common clinical features. Some less common clinical features among the participants of the present study were anuria, headache, hypertension, jaundice, and seizures. 64% of the present study participants had pre-renal AKI, 26% had a renal cause of AKI, and 10% had post-renal causes of AKI. The high prevalence of prerenal causes behind AKI was different from some global studies, where renal causes had a higher prevalence [19]. Following the Acute Kidney Injury Network classifications, 40% of the participants had stage 1 AKI, 28% had stage 2 and 32% had stage 3 type of AKI. 62% of the participants had complete recovery after being given the recommended medication, and 12% had some morbidity but had to leave the study without completing the treatment due to personal reasons. These 6 participants were released after significant improvement was observed in their health status. In the present study, the mortality rate was 22%, which was comparatively lower than some other children-focused studies [20-25]. This might be due to the geographical difference, along with some underlying disorders.

Limitations of the Study

The study was conducted in a single hospital with a 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 in more than 5 years. The most common clinical manifestation was Oliguria. The majority of the cases had pre-renal causes, and stage 2 AKI was the least common type of acute kidney injury. The majority of survived patients had complete recovery, with few mortalities.

RECOMMENDATION

The early detection of prerenal AKI and proper dehydration management would be the most effective measure to reduce the incidence of AKI. Moreover, Exclusive breastfeeding, proper handwashing, and vaccination would be other important preventive measures to reduce the diarrheal incidence.

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