

Community Acquired Acute Kidney Injury Among Children at Usmanu Danfodiyo University Teaching Hospital, Sokoto

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To cite this article

Jiya Fatima Bello, Ibitoye Paul Kehinde, Jiya Nma Muhammed, Jibrin Baba, Adamu Asma'u, Isezuo Khadijat Omeneke, Obasi Izuchukwu. Community Acquired Acute Kidney Injury Among Children at Usmanu Danfodiyo University Teaching Hospital, Sokoto. *Open Science Journal of Clinical Medicine*. Vol. 8, No. 1, 2020, pp. 1-6.

Received: April 15, 2020; Accepted: May 11, 2020; Published: June 8, 2020

Abstract

Background: Acute kidney injury (AKI) remains an important cause of morbidity and mortality particularly in developing countries. Community acquired forms are more prevalent in our setting, due perhaps to high occurrence of infectious diseases of relevance to the development of AKI. The *Objectives of the study were:* To determine the prevalence, pattern and outcome of AKI among children at Usmanu Danfodiyo University Teaching Hospital (UDUTH) Sokoto. This was a 2- year retrospective descriptive study from September 2015 to August 2017. Cases were children aged 2 months to 14 years admitted into Emergency Paediatric Unit (EPU) of Usmanu Danfodiyo University Teaching Hospital (UDUTH) Sokoto, with diagnosis of AKI using kidney disease improving global outcome criteria. Relevant information from their case folders were extracted into a profoma sheet and data was analyzed using SPSS version 20. **Results:** Thirty six of the 3493 admissions had diagnosis of AKI, giving a prevalence of 10.3 AKI cases per 1000 children. Males were 22 (61.1%) and females were 14 (38.9%), with M:F ratio 1.5:1. Mean age at presentation was 2.47 ± 1.4 years. Majority 20 (55.6%) were of low socioeconomic class. The common presenting symptoms were reduced or non-passage of urine in 23 (63.9%) of the patients, body swelling 22 (61.1%), and fever 14 (38.9%). Acute glomerulonephritis 10 (27.7%), Obstructive uropathy 7 (19.4%) and Septicaemia 6 (16.6%) were the commonest aetiologic diagnosis. Majority 21 (58.3%) of them had AKI stage 3. Three (50.0%) of the six patients with indication for dialysis underwent peritoneal dialysis. Twenty six (72.2%) of the 36 patients were discharged, 6 (16.7%) died and 4 (11.1%) left against medical advice. Of the 26 that were discharged, 14 (53.8%) were lost to follow up at 3 months. **Conclusion and Recommendation:** Acute glomerulonephritis is the commonest cause of AKI seen in this study. Majority were discharged but a significant number of them were lost to follow up. Preventive strategies at all levels of care still remains paramount.

Keywords

Acute Kidney Injury, Children, Presentation, Sokoto, Outcome

1. Introduction

Acute kidney injury (AKI) refers to an abrupt decline in renal excretory function characterized by a reversible increase in the blood concentration of creatinine and nitrogenous waste products often with decrease in urine

output and by the inability of the kidney to regulate fluid and electrolyte homeostasis [1]. The precise incidence of AKI in children is said to be unknown, but hospital based studies have reported an increase in its occurrence among paediatric patients, with varying incidence and causes of AKI between developed and developing countries [2]. Majority of the AKI cases occur as a result of community acquired infectious

diseases in the developing countries, in contrast with what obtains in advanced countries where AKI is said to occur more commonly in very sick older children with multi-organ failure and multiple co-morbid conditions in intensive care unit settings [3-5]. Acute kidney injury remains an important cause of morbidity and mortality worldwide, especially in the developing countries where cases have been reported to often present late, are under diagnosed or managed inadequately as a result of dearth of trained personnel, unavailability of facilities compounded by poor socio economic conditions and inadequate healthcare funding by the governments of these countries [6- 8].

Although the incidence of AKI also vary within different regions in Nigeria, the common causes of AKI in these regions appear similar and include malaria, acute diarrhoeal diseases, acute glomerulonephritis, haemolytic uraemic syndrome, septicaemia and obstructive uropathy with varying degrees of severity [3, 9-13]. Reports also indicate poor outcome of AKI in Nigeria with high mortality, which has been attributed to late presentation, high cost of care and unavailability of life saving therapies and supportive investigations [9-13]. The bulk of treatment requirement is borne by the caregiver with little or no support from the government as there is no provision for renal replacement therapy and its likes in the National health insurance scheme [14, 15].

There are no known reports on AKI among children in the study location, despite the high occurrence of common disease conditions of public health importance that can lead to AKI in our environment [16-19]. Additionally, the study location has been categorized under kidney stones (an important cause of post renal AKI) belt in Nigeria [20]. This study was conducted to determine the pattern, presentation and outcome of AKI among children admitted into the Emergency Paediatric Unit (EPU) of Usmanu Danfodiyo University Teaching Hospital (UDUTH) Sokoto. Information derived from the study is to be used as a baseline upon which to refer to in terms of raising awareness within the community, information dissemination and possibly engaging stakeholders in health care delivery within the study location on the need to give AKI the attention it deserves.

2. Materials and Methods

2.1. Study Area

The study was conducted at EPU of Usmanu Danfodiyo University Teaching Hospital Sokoto, a tertiary health facility located in Sokoto, the Capital of Sokoto State, North – Western Nigeria. The hospital serves as a referral center for people of Sokoto, Kebbi, Zamfara, Niger and Katsina states of Nigeria and neighbour's Niger and Benin Republics. The EPU of UDUTH is a 25 bedded unit designed to admit emergency medical conditions occurring in children aged 1 month to less than 15 years, with an average annual admission rate of 1,500 patients. Children below the age of 1 month are admitted into a separate unit referred to as the

special care baby unit (SCBU) of the department of Paediatrics UDUTH.

2.1.1. Study Design

This was a 2- year retrospective descriptive study from September 2015 to August 2017. Cases were children aged 2 months to 14 years admitted into Emergency Paediatric Unit (EPU) with diagnosis of AKI using kidney disease improving global outcome (KDIGO) criteria, which defined AKI as any of the following: increase in serum creatinine (SCr) by ≥ 0.3 mg/dl (≥ 26.5 $\mu\text{mol/l}$) within 48 hours; or increase in SCr to ≥ 1.5 times baseline, which is known or presumed to have occurred within the prior 7 days; or urine volume < 0.5 ml/kg/hour for 6 hours [21]. Cases with history of previous dialysis, transplant or existing chronic kidney disease; defined as abnormalities of kidney structure or function detected in urine, blood, histology or imaging or GFR < 60 ml/min/1.73m² for more than 3 months [22], and hospital acquired AKI were excluded from the study.

2.1.2. Data Collection

Relevant information from their case folders were extracted into a profoma sheet. Information recorded included demographic characteristics such as name, age, gender, address, ethnicity, educational status and occupation of parents. The social status was determined using Oyediji classification [23]. Presenting complaints, duration of illness, physical examination findings, laboratory investigations, diagnosis, treatment and outcome were also recorded.

2.2. Ethics Statement

Ethical approval for the study was sought and obtained from the Health Research and Ethics Committee of Usmanu Danfodiyo University Teaching Hospital Sokoto. The data obtained were treated with utmost confidentiality.

2.3. Data Analysis

Data was analyzed using SPSS version 20. The prevalence rate of acute kidney injury was presented as percentage while the age distribution of the cases was analyzed and expressed as mean and standard deviation. Frequency distribution tables and pie chart were used to illustrate results.

3. Results

Demographic Characteristics of the Cases

Thirty six (1%) of the 3493 admissions during the study period had diagnosis of AKI, giving a prevalence of 10.3 AKI cases per 1000 children. Males were 22 (61.1%) and females were 14 (38.9%), with M:F ratio 1.5:1. Their ages ranged between 2 months to 14 years with mean age at presentation of 2.47 ± 1.4 years. Majority (52.8%) were 5 years and below. Twenty (55.6%) of the patients were of low socioeconomic class. (Table 1).

Table 1. Demographic Characteristics of the cases.

Characteristics	Frequency n (%)
Demographics of Children	
Age, mean (SD)	2.47 ± 1.4
Male gender	22 (61.1)
Female gender	14 (38.9)
Social status	
Low	20 (55.6)
Middle	12 (33.3)
High	4 (11.1)

Presenting Features and Diagnosis of the Cases

The average duration of hospital stay was 16 days. The common presenting symptoms were reduced or non-passage of urine in 23 (63.9%) of the patients, body swelling 22 (61.1%), and fever 14 (38.9%). Other features were associated with the underlying causes of AKI. Majority 21 (58.3) had AKI stage 3. Nine (25.0%) and 6 (16.7%) of the patients had AKI stages II and I respectively.

Acute glomerulonephritis 10 (27.7%), Obstructive uropathy 7 (19.4%) and Septicaemia 6 (16.6%) were the commonest aetiologic diagnosis. (Tables 2 and 3).

Table 2. Aetiologic diagnosis of patients with Acute Kidney Injury.

Diagnosis	Frequency n (%)
Acute Glomerulonephritis	10 (27.7)
Obstructive Uropathy*	7 (19.4)
Septicaemia	6 (16.6)
Nephroblastoma	4 (11.1)
Malaria	2 (5.6)
Acute diarrhoeal disease	2 (5.6)
Meningitis	2 (5.6)
Haemolytic uraemic syndrome	1 (2.8)
Nephrotic syndrome	1 (2.8)
Congestive cardiac failure	1 (2.8)
Total	36 (100)

*Six cases of nephrolithiasis, one case of posterior urethral valve.

Table 3. Presenting symptoms of cases diagnosed.

Clinical Symptoms*	Frequency n (%)
Reduced or non-passage of urine	23 (63.9)
Body swelling	22 (61.1)
Fever	14 (38.9)
vomiting	08 (22.2)
Passage of loose stools	05 (13.9)
Abdominal pain	02 (5.6)
cough	05 (13.9)
Difficulty in breathing	03 (8.3)
Change in urine colour	04 (11.1)
dysuria	01 (2.8)
Headache	05 (13.9)
Unconsciousness	01 (2.8)
Convulsion	01 (2.8)

*Cases had more than one symptom at presentation

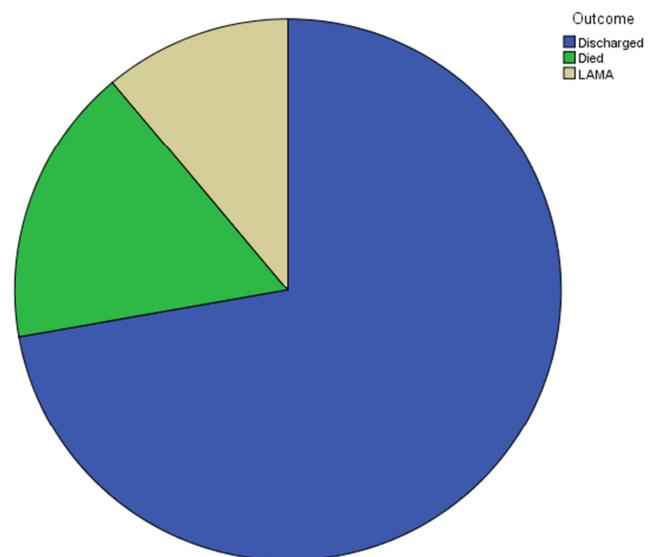
Features of Cases That Required Dialysis

Six (16.7%) patients had indications for dialysis, five out of which were aged below five years. Each of the patients needing dialysis had more than one indication. The indications for dialysis were symptomatic fluid overload refractory to medical treatment (3), severe metabolic acidosis

of serum bicarbonate <12 mmol/l (3), symptoms of uraemia (2), and severe hyperkalaemia (serum potassium >7.0 mmol/l) in 2 patients. Of the six patients requiring dialysis, only 3 (50.0%) underwent peritoneal dialysis. Two out of the three patients needing dialysis could not be dialyzed because the caregivers left against medical advice on account of financial constraint while the third patient succumbed to AKI within 48 hours of admission.

Outcome of Cases Diagnosed

Twenty six (72.2%) of the 36 patients were discharged, 6 (16.7%) died and 4 (11.1%) left against medical advice (Figure 1). Of the six patients that died, the associated comorbidities were overwhelming septicaemia in 3 (50%) patients, severe anaemia in 2 (33.3%) patients, and severe acute malnutrition in 1 (16.7%) of the cases.

**Figure 1.** Outcome of cases of acute kidney injury.

Outcome of Discharged Cases

Of the 26 patients that were discharged, 10 (38.5%) had no kidney disease, 2 (7.7%) progressed to chronic kidney disease (cases were chronic Glomerulonephritis, Focal Segmental Glomerulosclerosis), 14 (53.8%) were lost to follow up at the end of three months follow up visits. Nine (64.3%) out of the cases that were lost to follow up were of low socioeconomic status.

4. Discussion

The prevalence of AKI in this study compares favourably with those of Olowu et al in Ife, South-West Nigeria, and with reports from Ghana and Cameroon, [3, 24, 25]. Comparing the prevalence with other reports from Nigeria and Uganda, [9-11, 13, 26, 27] the prevalence of AKI is lower in this study. The retrospective nature of this study may explain the low prevalence being reported because cases of mild or transient AKI might have been missed as at the time of presentation to the emergency paediatric unit, or poorly documented. The upper age limit set in this study being lower than those of other studies could also explain the

variation of the observed prevalence. Additionally, this study unlike in other studies, focused on the emergency paediatric unit of the hospital and also excluded hospital acquired AKI. Overall, this study underscores the need to be more vigilant in detecting cases of AKI especially in the paediatric emergency setting and the paediatric units of our study location.

Majority 21 (58.3%) of the cases in this study having severe form of AKI (stage 3) is comparable to other studies in South-west Nigeria where reports show severe forms of AKI in a significant proportion of the patients [10, 27]. It was thought to be associated with the late presentation of sick children to hospitals in developing countries, owing to the fact that healthcare is fee-for-service and the proportion of families with health insurance is small, with majority being unable to seek for early healthcare intervention [10, 27]. The reasons could be said to be similar to what obtains in our own setting, considering the proportion (55.6%) of patients whose socioeconomic status was low. More so, the study location is situated in the region of the country considered to be socioeconomically disadvantaged [28]. Additionally, over-reliance on elevated serum creatinine in the diagnosis of AKI as has occurred in this study is not without flaws, as it is considered less sensitive than other not readily available early biomarkers of AKI [29, 30]. In contrast to our study however, reports from some studies conducted in the developed countries revealed majority of their patients having mild forms of AKI [31-33].

The aetiologic diagnosis of AKI in this study compares with reports from other studies where primary renal diseases and sepsis, were documented among some of the common causes of AKI. Obstructive uropathy mostly from renal calculi was however, the second commonest cause of AKI in this study. This could be explained by the fact that the study location has been categorized under the kidney stones belt of Nigeria [20] with increasing risk of development of obstructive nephropathy among the inhabitants of this location. It is therefore important to always have a high index of suspicion of renal stones as a cause of AKI in children

presenting with features of AKI from the study location. Malaria and gastroenteritis in contrast to earlier reports [3, 7, 9] were not common causes of AKI in this study. Our finding was however, consistent with the report from the study by Esezobor *et al* where malaria and gastroenteritis-related AKI were found to be on the decline, further agreeing with their suggestion that the relative contribution of each of these diseases to AKI in children in Nigeria may be changing [10]. The low prevalence of malaria related AKI in this study could also be attributed to significant progresses reported to have been made in the efforts at Malaria control in the study location and some other parts of Nigeria [34]. Haemolytic uraemic syndrome as a cause of AKI in this study was uncommon and comparable to reports from other studies [10, 24].

Although still unacceptably high, the mortality from AKI in this study of 16.7% was lower than reports from other studies [3, 9-11]. This could be related to most of the patients responding to conservative treatment of the complications of

AKI in addition to definitive treatment of the underlying aetiologies. Although majority 58.3% of the cases had AKI stage 3, only 16.7% of the 36 cases qualified for the need for acute dialysis, which was successfully performed on three of the cases and were subsequently discharged with no evidence of kidney disease at the end of 3 months follow up visit. The inability to perform dialysis in all patients with indication for it is not peculiar to this study. Previous studies have reported similar scenarios with variety of reasons making accessibility to dialysis suboptimal for all patients with AKI requiring renal replacement therapy [3, 9, 10]. In most developing countries, the parents are said to provide the bulk of the fund for renal replacement therapy [35]. The three cases that couldn't be dialyzed in this study were all of low socioeconomic status. Though one of them died within 72 hours of admission, the caregivers of the other two cases left with the patients against medical advice on account of financial constraint. In the absence of social insurance coverage, it is almost impossible to retain and treat such cases adequately as there are other competing needs that would also be requiring attention.

The high rate of patients been subsequently lost to follow up visit at the end of three months in this study might also not be unconnected to caregiver exhaustion from the financial requirements of having to continue follow up visits at short intervals, until the outcome of discharge can be determined. More so, 64.3% of them were of low socioeconomic status. This finding brings to fore, the need for regular counselling sessions with patients (of sufficient age) with AKI and their caregivers in addition to other possible coping strategies. It is important that they be well informed and encouraged to continue follow up visits as even a single episode of AKI has been documented to increase the risk of development of chronic kidney disease in affected individuals [1].

5. Conclusion

Acute glomerulonephritis is the commonest cause of AKI seen in this study. Renal stone is an important aetiology in cases from the study location. Majority had AKI stage 3 but only few required acute dialysis. Most of them were successfully managed and discharged but a significant number of them were subsequently lost to follow up. Preventive strategies at all levels of care still remains paramount.

Funding Statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Author Contribution

Fatima Bello Jiya: Conceptualization, study design, data analysis, writing original draft

Paul Kehinde Ibitoye, Nma Muhammed Jiya: writing, reviewing, editing

Jibrin Baba, Adamu Asma'u, Isezuo Khadijat O, Obasi I: Data collection, analysis and interpretation.

All authors approved the submission of the final draft.

Conflicts of interest

The authors declare that they have no competing interests.

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