Pattern of Kidney Disease among Children Admitted in a Tertiary Health Institution in South West Nigeria—A 7-Year Review

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Abstract

Background: Kidney diseases in children are gradually been reported more with increasing awareness in the developing countries. This manuscript mainly investigated the pattern of kidney disease among children admitted in our hospital over a 7-year period, the treatment interventions given and the outcome. The data obtained was analyzed using SPSS version 16. Descriptive statistics showing frequencies and percentages were used. The Independent Samples T-Test was used to compare mean age of both male and female patients. The result showed 102 cases of paediatric renal diseases which constituted 1.7% of the total patients (6014) admitted over this period. Fifty-nine (57.8%) of these renal cases were male while forty-three (42.2%) were female. The age range of the patients was 1 month to 16 years. The highest number of kidney diseases was reported among school-age children, 44 which constituted 43.1% of the total number with kidney disease while the least figure was recorded among newborns and infants. The most common childhood renal disease reported was urinary tract infection, 31 (30.4%), this was followed by acute kidney injury (AKI), 25 (24.5%) from various causes such as hypovolaemia, sepsis and haemoglobinuria. The various treatment modalities offered included medications, dialysis and surgical interventions. Eighty-two (80.4%) of those admitted were discharged to the Nephrology clinic after clinical improvement while 4 (3.9%) of them left against medical advice. Six (5.9%) of the total number of children with renal disease died and 10 (9.8%) were referred. In conclusion, the prevalence of renal diseases among children admitted as reported in the study was 1.7%, with school-age children more affected. Urinary tract infection was the most common renal disease seen in the studied population.

1. Introduction

Kidney disease remains a major cause of morbidity and mortality in children [1] [2]. They are under-reported among children in the tropical regions [3], one of the reasons that may account for this is missed diagnosis; the prevailing parasitic infections in the tropics, such as malaria fever with majority of its symptoms like fever, nausea and vomiting, overlapping with that of urinary tract infection, a common bacterial infection seen in children of all ages [4] may lead to missed diagnosis. Another reason that may account for this is the health seeking attitude of the people. There is a relative ease in purchasing antibiotics over the counter, once antimalarial is used and there is no relief of symptoms, the next course of action is to try antibiotics that alleviates these symptoms and the patient may never get to the medical facilities for proper assessment, investigation and treatment. Poor antenatal care [5] and failure of health care workers to recognize kidney diseases early has been reported as more than 90% of children with posterior urethral valve, a common cause of CKD in Nigeria, are diagnosed after birth [6]. The contribution of pediatric renal disease to overall childhood morbidity and mortality in our environment has been noted to be on the increase [3], hence the need to have a renal registry that will aid government policies towards prevention at various levels. The aim of this study is to bring to the limelight the pattern of kidney diseases seen among children presenting to the tertiary teaching hospital, the treatment received and the outcome.

2. Methodology

This was a retrospective study involving the review of paediatric patients with the diagnosis of renal disease admitted over a period of 7 years (February 2015-February 2022), in a state-owned tertiary health care facility, Ekiti State University Teaching Hospital, Ado Ekiti, located in the South-Western part of Nigeria. Following the institution's ethical approval, the admission register of the Paediatric unit was retrieved and reviewed. Subsequently, the data of patients with renal diseases such as; age at presentation, gender, presenting complaints, treatment modalities and clinical outcome were obtained. The information obtained was compared with the paediatric renal register kept by the paediatric nephrology unit comprising of a paediatric-nephrology trained consultant, resident doctors and house officers, this is to ensure that no data was missed. The diagnosis of the various ailments was made following standard protocol; UTI diagnosis was based on urine culture when the isolated bacterial colony was 10^5 or more per

ml, chronic kidney disease (CKD) diagnosis was made on evidences of bilateral structural or functional abnormality that has been on-going for ≥3 months. Acute kidney injury was based on sudden deterioration in kidney function as evidenced by an increase in serum creatinine by ≥0.3 mg/dl (≥26.5 μmol/L) within 48 hours; or urine output < 0.5 ml/kg /hr for a period of 6 hours, an assessment of nephrotic syndrome was based on the presence of oedema, massive proteinuria (>40 mg/m^2/day) and hypoalbuminaemia < 25 g/L. Acute glomerulonephritis (AGN) was diagnosed on account of the presence of hematuria or red blood cell casts, hypertension, oedema, and proteinuria.

The data obtained was analyzed using SPSS version 16. Descriptive statistics showing frequencies and percentages were used. The Independent Samples T-Test was used to compare the mean age of both male and female patients. Chi-Square Test was used to explore the relationship between categorical variables. P-value < 0.05 was considered statistically significant.

3. Results

Six thousand and fourteen children were admitted over the period of the study (7-years). One hundred and two (1.7%) of them had various renal diseases. The age range of the patients was 1 month to 16 years. Fifty-nine (57.8%) of these renal patients were male while forty three (42.2%) were female with (M: F-1.4:1), the mean age for males was 8.9 ± 4.7 years while that of females was 7.0 ± 4.6 years, there was no significant difference in the mean age between the gender (P = 0.11). The distribution of the disease according to gender is as shown in Table 1.

Some of the diseases overlap, for instance Acute Kidney Injury (AKI) complicating acute glomerulonephritis (AGN) and nephrotic syndrome. The most common childhood renal disease reported was urinary tract infection (pyelonephritis and lower urinary tract infection), 31 (30.4%), this was followed by acute kidney injury (AKI), 26 (25.5%) from various causes such as hypovolaemia, sepsis and haemoglobinuria.

The distribution of renal diseases among the age group is as shown in Figure 1. The highest number of kidney diseases was reported among the school-age children; they were 44 and constituted 43.1% of the total number with kidney disease while the least figure was recorded among newborns and infants. The mean age for children with AGN was 8.2 ± 4.3 years while that of nephrotic syndrome was 6.1 ± 3.7 years, there was no statistically significant difference (P = 0.23) in the ages of children with these two renal diseases. Cases of Congenital anomalies of the kidney and urinary tracts (CAKUT) seen in the study included 2 patients with posterior urethral valve, diagnoses made at ages 4 and 6 years respectively and an 11-year-old with multicystic kidney disease. They were all detected by abdomino-pelvic ultrasound following episodes of recurrent UTI.

The pattern of renal diseases is such that AKI was seen across all the age groups however the causes of AKI differ from one age group to the other. Figure 2 shows the aetiology of AKI; in children of age ≤ 3 years, the causes were majorly;
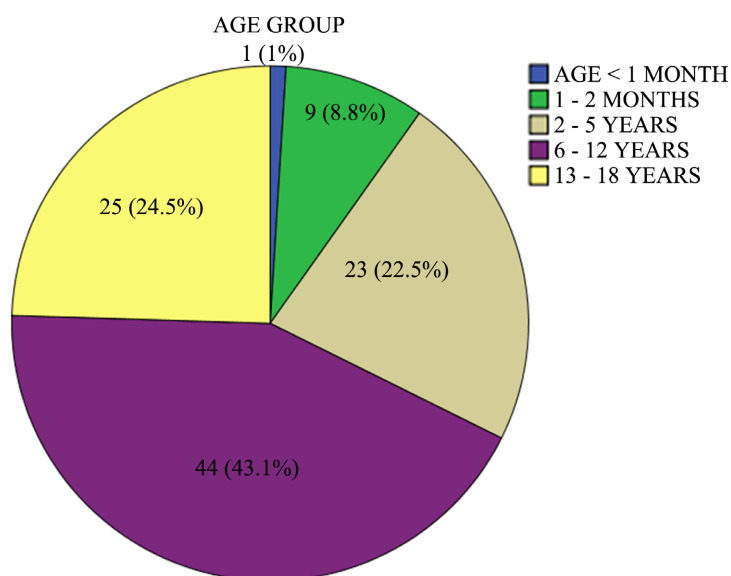
AGE GROUP

Figure 1. Age group of children with kidney diseases.

Table 1. Gender distribution and frequency pattern of renal diseases in the patients.

	Disease	Frequency	Male	Female
1	Childhood hypertension and obesity	1	1	0
	Acute Kidney Injury with:			
	a) Haemoglobinuria	5	2	3
	b) Sickle cell anaemia	3	3	0
2	c) Nephrotic syndrome	1	1	0
	d) Sepsis	9	5	4
	e) Severe dehydration	3	1	2
	f) Glomerulonephritis	5	3	2
3	Posterior urethral valve with reflux nephropathy	2	2	0
4	Chronic glomerulonephritis	12	10	2
5	Systemic lupus erythematosus	1	0	1
6	Pyelonephritis	3	1	2
7	Cystinuria	1	0	1
8	Renal stone	6	4	2
9	Nephrotic syndrome	12	5	7
10	Rapidly progressive glomerulonephritis	1	1	0
11	Multicystic kidney disease	1	1	0
12	Acute glomerulonephritis	13	7	6
13	Lower urinary tract infection	28	14	14
14	Wilm's tumor	1	1	0

sepsis and severe dehydration while the causes in ages ≥ 4-years were haemoglobinuria and glomerulonephritis.

The various treatment modalities offered included oral and parenteral medications such as antibiotics for infections, diuretic, steroid and antihypertensive. Other treatment modalities used were peritoneal dialysis, haemodialysis and surgical interventions especially in instances of obstructive uropathy as shown below in Figure 3.
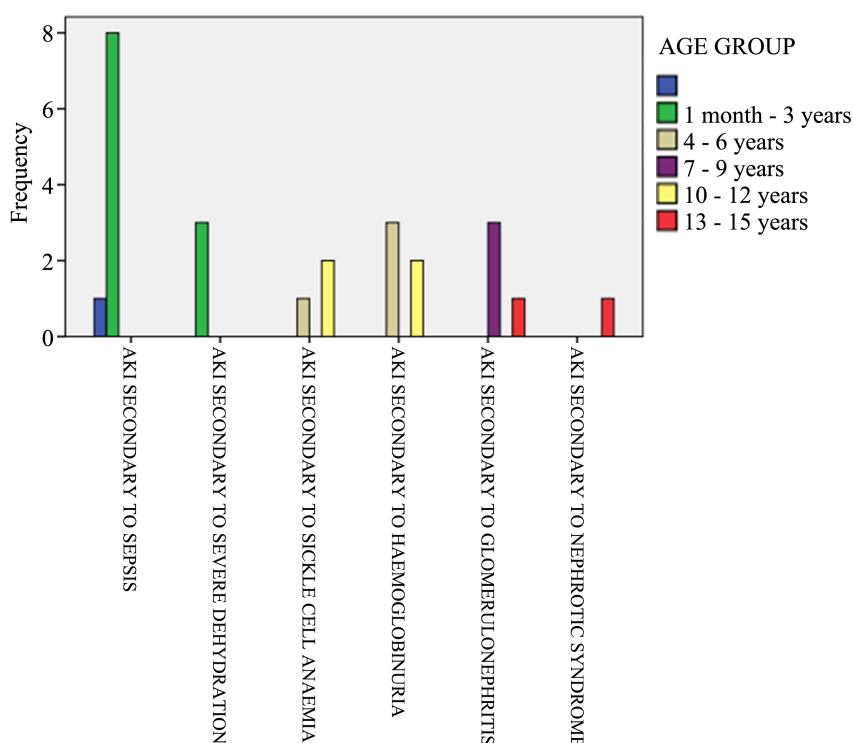

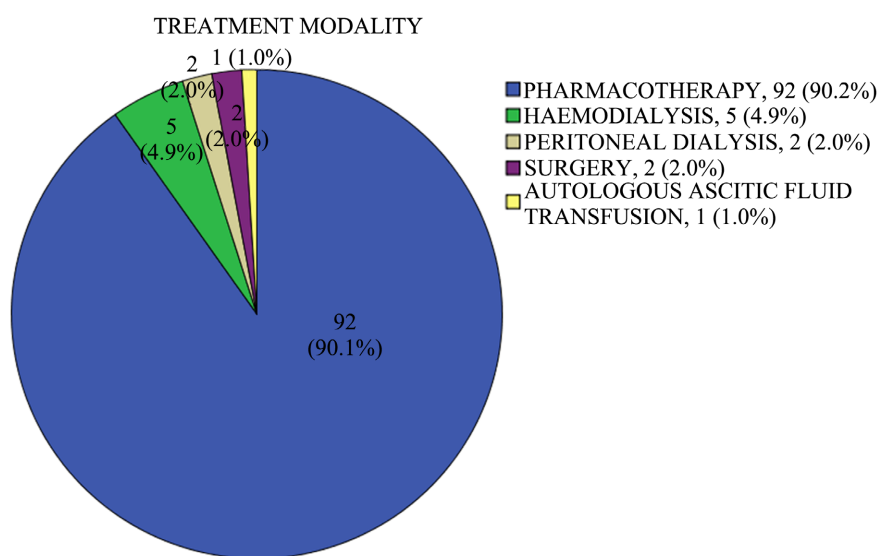**Figure 2.** Aetiology of Aki across the age groups.

Figure 3. Various treatment modalities in the patients.

Eighty two (80.4%) of those admitted were discharged to the Nephrology clinic after clinical improvement while 4 (3.9%) of them left against medical advice, these included 2 patients with AKI being planned for dialysis but could not afford it. Mortality was 5.9% (6 patients) of the total number of children with renal disease. The mortalities were patients with; chronic kidney disease (chronic glomerulonephritis (3 patients), posterior urethral valve with grade 4 reflux nephropathy (1 patient), nephrotic syndrome complicated by AKI (1 patient) while the remaining one was a newborn who developed AKI following sepsis. Ten (9.8%) were referred on account of need for surgical intervention, chemotherapy, renal replacement for those with Chronic kidney disease.

4. Discussion

The prevalence of renal diseases among the children admitted during the study period was 1.7% which is lower than the 8.9% prevalence reported by Ladapo *et al.* [3] and also 3.9% reported by Etuk *et al.* [7] in Calabar in their studies. These earlier studies were done in bigger tertiary health institutions with more resources and manpower and a higher tendency to have more referrals. The male:female ratio of 1.4:1 is close to earlier reports of 1.9:1 by Ladapo *et al.* [3], 1.7:1 by Obiagwu *et al.* [8] in Kano and 1.9:1 reported by Khemchand *et al.* [9]. There does not seem to be any wide difference in the ratio across gender from one institution to the other, and there is a predominance of renal diseases among male children. Obiagwu [8] attributed this to the fact that in Nigeria, male children are considered valuable and this may account for the willingness to bring them to the hospital for evaluation when ill. Among the various renal diseases seen in the index study, Urinary tract infection was most common, followed by AKI. This is at variance with the report from Obiagwu *et al.* [8] in Kano, Northern Nigeria where Nephrotic syndrome was the most prevalent followed by AGN and AKI, similarly, Ladapo *et al.* [3] also reported Nephrotic syndrome as most common followed by AKI and Nephroblastoma. Acute kidney injury (AKI) and nephrotic syndrome were earlier reported to be the most common paediatric kidney diseases in Africa [3] [8] [10] [11]. The prominence of the symptoms of Nephrotic syndrome such as body swelling as well as the alarming situation of reduction in urine output may warrant early presentation in the hospital facility with reduced likelihood of missed diagnoses. However, with improved awareness and use of screening and investigative tool such as bedside urinalysis, urine culture and radiological investigations, there is bound to be changes in the pattern of renal diseases as witnessed in the index study. A recent study done in Abuja [12], Nigeria showed a similar result of UTI being the most common renal disease seen in children, followed by AKI. Another factor that may contribute to the change in pattern over time could be the increasing awareness and effectiveness of the various child survival strategies such as immunization against rotavirus which is the most common cause of acute watery diarrhea with its potential to cause AKI from severe dehydration, vaccine campaign against Hepatitis B which is a cause of Nephrotic syndrome, less cases

of measles due to more impactful vaccination programmes, the effectiveness of prevention of mother to child transmission of HIV etc., all these are likely to contribute to the changes in pattern of renal diseases. Genetic, racial, and environmental differences had also been implicated in the regional variability of the pattern of kidney diseases seen in children [1].

Acquired renal diseases were more than congenital anomalies of the kidneys and the urinary tract, this has been the trend from earlier reports from research works done in developing countries unlike in the developed world [13], the reason that can be attributed to this include missed diagnosis during the prenatal and perinatal period, this results in children with CAKUT presenting late with features of STAGE 3 - 5 of chronic kidney diseases. Cases of Congenital anomalies of the kidney and urinary tracts seen in the index study included; 2 patients with posterior urethral valve, diagnosis made at ages 4 and 6 years respectively, an 11 year old with multicystic kidney diseases. These disease entities were identified when these patients were being investigated for recurrent episodes of UTI. Prompt diagnosis and early intervention could have halted or slowed down the progression to CKD. Antenatal ultrasound targeted at identifying fetuses with congenital anomalies of the kidneys and the urinary tract is not always done in low socioeconomic areas as access to antenatal care has been reported to be low in Nigeria [5], pregnant women often visit other centers aside registered health institutions for their antenatal care, places such as herbal homes, religious houses etc. PUV was the most common CAKUT seen in index study, this had been similarly reported to be the most common CAKUT seen in previous studies [1] [14] [15]. Some other congenital anomalies of the kidneys and urinary tract could have been missed due to poor health seeking behavior and lack of proper diagnostic tools, this may be a limitation in this study.

In this study, the school-age children of ages 6 - 12 years were the prominent age with renal diseases. It has been previously noted that paediatric renal disease may be difficult to diagnose in younger children early as it may present only with mild non-specific symptoms [16]. UTI is the most common renal disease seen in this study, the clarity and specificity of the symptoms of UTI improve as the child grows and is able to express himself in describing symptoms such as dysuria and loin pain, this raises the index of suspicion in the attending physician and prompts him to investigate further.

The aetiology of AKI appears to differ from age to age in the index study. In children of age ≤ 3 years, sepsis and severe dehydration were the most common causes of AKI hereby making prerenal causes of AKI more prominent in this age while haemoglobinuria, glomerulonephritis (intrinsic renal AKI) were more prevalent in patients ≥ 4 years of age. Younger children have a greater tendency to be severely dehydrated from gastroenteritis unlike older children. Seven (26.9%) of the 26 patients with AKI had renal replacement therapy in terms of haemodialysis (5) and peritoneal dialysis (2). The low rate of dialysis among AKI patients could be attributed to the challenge of affordability, the first session of haemodialysis is about #40,000 and the subsequent session is about #27,000. This

is a huge cost in a country with a minimum wage of #30,000 per month. This was demonstrated in this study as 50% of patients that left against medical advice were cases of AKI being prepared for dialysis. Olowu *et al.* [17] reported that major barriers to access to care were out-of-pocket costs and that many patients cannot meet such costs and are forced to decline treatment in sub-Sahara Africa.

Renal disease is associated with great morbidity and mortality, 6.0% of the patients admitted for renal diseases died in this study, higher mortality of 14.4% was reported by Ladapo *et al.* [3], acute kidney injury accounted for 36% of the mortality and this may explain the high mortality.

Patients were referred for surgical intervention in instances of meatal stenosis, PUV, Wilms tumor and renal transplant; while the majority (80.4%), were discharged to the clinic for follow up. This showed that all hope is not lost for children with renal disease, with improvement in knowledge, skill, and appropriate investigations as well as therapeutic interventions; there is likely going to be a reduction in mortality associated with renal disease.

5. Conclusion

In conclusion, the pattern of renal diseases may not remain static over time as various preventive interventions take root in developing countries. Improved access to genetic studies, emphasis on prenatal screening for CAKUT, good socioeconomic state and health education to sensitize the public about proper health-seeking behavior may reveal a similar pattern to what obtains in the developed world in a couple of years to come.

Conflicts of Interest

The authors declare no conflicts of interest.

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