J Ped Nephrol
Journal of Pediatric Nephrology
Winter 2022. Volume 10. Number 1

Original Article:

Pediatric Renal Admission: Clinical Spectrum and Outcome, the Experience of Two Semi-urban, Secondary Hospitals in Cameroon

Denis Teuwafeu[1,2*], Alex Mambap[3,4], Franck Foin[1], Yolande Puepi[1,2], Ronald Gobina[2], Gloria Ashuntantang[4]

1. Faculty of Health Sciences, University of Buea, Buea, Cameroon.
2. Regional Hospital Buea, Buea, Cameroon.
3. Faculty of Health Sciences, University of Bamenda, Bamenda, Cameroon.
4. Bamenda Regional Hospital, Bamenda, Cameroon.

Use your device to scan and read the article online

Citation Teuwafeu D, Mambap A, Foin F, Puepi Y, Gobina R, Ashuntantang G. Pediatric Renal Admission: Clinical Spectrum and Outcome, the Experience of Two Semi-urban, Secondary Hospitals in Cameroon. Journal of Pediatric Nephrology. 2022; 10(1):7-16. https://doi.org/10.22037/jpn.v10i1.36263

https://doi.org/10.22037/jpn.v10i1.36263

Article info:
Received: Sep 2021
Accepted: Nov 2021
Published: Jan 2022

Corresponding Author:
Denis Teuwafeu
Address: Faculty of Health Sciences, University of Buea, Buea, Cameroon.
E-mail: d.teuwafeu@yahoo.com

ABSTRACT

Background and Aim: There is limited information on renal diseases in pediatric admissions in Cameroon. We aimed to describe the clinical spectrum and outcomes of renal diseases among admitted children in two regional hospitals in Cameroon.

Methods: This research was a 4-year retrospective study where archived records of children admitted with renal disease in two regional hospitals from January 1, 2017, to December 31, 2019, were reviewed. We defined renal admission as any structural or functional abnormality of the kidneys and urinary tract on or during hospitalization.

Results: In total, 148 children (1.98%) of the 7457 admitted children had renal diseases. Their median age was 7.5 years (IQR: 4-12), and 63.5% were females, with 32.4% less than 5 years. Their underlying conditions were as follows: Urinary Tract Infection (UTI; 51.4%), Acute Kidney Injury (AKI; 21.6%), nephrotic syndrome (12.2%), and Chronic Kidney Disease (CKD; 12.2%). Children with UTI were significantly younger. Complicated UTI was observed in 9.2% of children with UTI. Initiation of corticotherapy (83.3%) was the most common reason for admission in children with nephrotic syndrome. Malaria (40.6%) and sepsis (40.6%) were the most common etiologies of AKI. Chronic glomerulonephritis was the most common etiology of CKD. Out of the 32 children with AKI, 50% (n=16) had an indication for dialysis, with 87.5% (14 out of 16) having access to the therapy. Nine (75%) of the 12 children with stage 5 non-dialysis CKD needed dialysis, with 55.5% (5 out of 9) having access to it. Out of 148 children, 7 (4.7%) died. Deaths were due to AKI 12.5% (4 out of 32) and CKD 16.7% (3 out of 18).

Conclusion: The most common renal diagnoses were UTI, AKI, and nephrotic syndrome. Overall in-hospital mortality was low and observed only in cases with AKI and CKD.

Keywords: Kidney Diseases, Clinical spectrum, Outcome, Child admission

J Ped Nephrol
Journal of Pediatric Nephrology

Introduction

Over the years, pediatric renal diseases have become one of the leading causes of morbidity and mortality worldwide [1]. Estimates of the global burden of disease indicate that the kidney and urinary tract disorders account for approximately 830000 deaths and 18467000 disability-adjusted life years annually, ranking them the 12th among causes of death (1.4% of all deaths) and the 17th among causes of disability (1.0% of all disability-adjusted life years) [2]. The pattern of renal diseases among pediatric admissions varies in different populations because of genetic differences, access to health care, socioeconomic status, the spectrum of background infections, and the study setting [3]. In general, the prevalence of kidney diseases among pediatric admissions varies between 1.2% and 16.5% [3]. The renal diagnosis described includes congenital abnormalities, Acute Kidney Injury (AKI), Chronic Kidney Disease (CKD), Urinary Tract Infections (UTI), nephrotic syndrome, renal calculi, and nephroblastoma. In Africa, there is a shortage of literature on pediatric renal disorders due to the slow development of the subspecialty, lack of trained staff, and availability of highly technical resources, such as renal histopathology, dialysis machines and solutions, immunosuppressive drugs, and transplantation services. However, in certain parts of Africa with pediatric nephrology centers and some tertiary centers, the percentage of renal disease among hospitalized children varies, with recent studies reporting a prevalence of up to 8.9% [4-8]. Malaria, septicemia, HIV, sickle cell anemia, Hepatitis B, and schistosomiasis have been documented as some of the frequent causes of renal disease in the sub-region [5, 6, 8-11].

Unlike the situation in high-income countries, where Congenital Abnormalities of the Kidneys and Urinary Tract (CAKUT) account for about 50% of CKD, they are rare in sub-Saharan Africa (SSA) owing to lack of antenatal screening in this region [12-15]. Despite the increased interest in nephrology and pediatric nephrology in Cameroon over the past 10 years, there are still insufficient data regarding the spectrum of renal diseases in children. In this study, we assessed the spectrum and clinical characteristics of Cameroonian children with renal disease presentations at the nephrology unit of two regional hospitals with a nephrologist and no pediatric nephrologist.

Materials and Methods

Study design and site

This research was a retrospective study conducted over 4 years. All files of patients less than 18 years with renal disorders admitted to the Pediatric Unit of the Buea and Bamenda regional Hospitals from January 1, 2017, to December 31, 2019, were included in the study. Both hospitals are teaching and reference hospitals for the regions. The presence of dialysis and a kidney specialist in both hospitals encourage the referral of all patients with suspected renal diseases. Both hospitals run an accredited laboratory where there is no pediatric nephrologist, but the nephrologists review all cases of renal diseases.

Eligibility criteria

All patients' files diagnosed with kidney diseases at the pediatric unit of both hospitals under the study years were eligible for the study. We excluded files with important missing data.

Procedure and data collection

Ethical approval and administrative authorization were obtained before accessing patients' files.

Demographic characteristics such as age, gender, occupation, geographical location, clinical features of the patients, examinations, laboratory and radiological investigations, hospital discharge diagnoses, final outcome, and referral notes were retrieved from files and recorded in a spreadsheet protocol from Microsoft Office Excel, created to collect these data. We considered only the first hospitalization for patients admitted several times for the same disease. For those with several diagnoses, each diagnosis was counted separately. The kind of renal disease presentation was taken as diagnosed in the file by the nephrologist or the attending physician. In the absence of a diagnosis, the nephrologist reviewed the file. Severity/stage was established using KDIGO classification for AKI and NKF-KDQOI classification for CKD. The need and dialysis access was reported as a documented report by the attending nephrologist. The outcome variables included discharge with improvement, discharge against medical advice (as reported in the file), transfer (as reported in the file), or death.

Data analysis

Data obtained from the study were entered and stored into Census Survey pro (CSPro) version 7.2 and ana-

lyzed in SPSS version 25. Continuous variables are expressed as median and inter-quartile ranges. Qualitative variables are expressed as percentages. The Chi-squared test was used to compare categorical variables, while the independent samples median test was used to compare medians. Statistical significance was set at P<0.05.

Results

General profile of the study population

During the 4 years study, out of 7457 records of admitted children, 148 had a confirmed renal disease hence there is a prevalence of 1.98%. Of 148 cases, 60.1% were girls (n=89). About one-third of children were less than 5 years old. More than half (56.1%, n=83) were from urban areas (Table 1). Emergency admissions accounted for 70.3% of all renal admissions. Malnutrition (42.3%, n=11), sickle cell anaemia (34.6%, n=9) and HIV (19.2%, n=5) were the most common comorbidities. Among those with HIV (n=5), 2 were in stage 2, 1 in stage 3, and 2 in stage 4 according to the World Health Organization (WHO) classification for HIV.

Types of renal disease/syndromes

As shown in Figure 1, Urinary Tract Infection (UTI) was the most common renal disease (51.4%, n=76) followed by AKI (21.6%, n=32), nephrotic syndrome (12.2%, n=18), and CKD (12.2%, n=18). Children with UTI were younger (P=0.011), whereas those with CKD were older. All 4 children with renal mass were male with a median age of 10.5 (5.75-13.75 y) years.

Clinical characteristics of renal diseases

Characteristics of UTI children (n=76)

The most frequent clinical features of UTIs were fever (81.6%, n=62), abdominal pain (51.3%, n=39) and vomiting (40.8%, n=31). Complicated UTI was observed in 9.2% (n=7) of children (Table 2).

Characteristics of AKI children (n=32)

The most frequent features at presentation of AKI children were fever (68.8%, n=22), oligoanuria (56.3%, n=18), and abdominal pain (43.8%, n=14). AKI was severe (stage 3 KDIGO) in 84.4% (n=27) of cases. Malaria (40.6%, n=13) and sepsis (40.6%, n=13) were the most common aetiologies. The need for dialysis was reported in 50% (n=16) of cases with 87.5% (n=14) of them accessed it (Table 3).

Characteristics of children with nephrotic syndrome (n=18)

All children presented with anasarca (100%, n=18). The most common reasons for admission were initiation of corticotherapy (83.3%, n=15) and infection (33.3%, n=6) (Table 4).

Characteristics of children with CKD non-dialysis (n=13)

The most frequent clinical presentation of CDK children were anemia (76.9%, n=10), vomiting (38.5%, n=5) and abdominal pain (30.8%, n=4). Chronic glomerulonephritis was the most common etiology (53.8%, n=7). There were 2 (15.4%) cases with CAKUT. all were Posterior Urethral Valves (PUV). Severe anemia (75% n=9) and fluid overload (75%, n=9) were the most common reasons for admission (Table 5). Among children in stage 5 CKD, 75% (n=9) needed dialysis with 55.5% (n=5) had access to it.

Characteristics of children on maintenance haemodialysis (n=5)

Of 5 participants on maintenance haemodialysis (80%, n=4, all female), the median dialysis vintage was 3 (range; 3-17 mo) months. All children (100%, n=5) had a temporal central venous catheter. Chronic glomerulonephritis was the most common etiology (60%, n=3). Severe anemia (n=2, 40%) and fluid overload (n=2, 40%) were the most common admission diagnosis (Table 6).

In-Hospital outcome of children with renal disease

Children with UTI had a good prognosis. The mortality rate was 4.7% and reported in children with AKI (57.1%) and CKD (42.9%) with no significant difference (P=0.684). Among the children with renal mass, 1 was transferred, and 3 were discharged.

Discussion

The prevalence of renal diseases among pediatric admissions varies between 1.2% and 16.6% [16-23] due to differences in methodology, study setting, geographical locations, and population studied. It is the highest in tertiary centers and pediatric nephrology clinics and lowest in rural settings and areas that lack renal replacement therapy facilities. In this study, we obtained a prevalence of 1.98%, which falls within the range of previous reports. This prevalence is comparable to 1.7% reported in Southeast Nigeria [15] and 1.58% in India [24]. How-

J Ped Nephrol
Journal of Pediatric Nephrology

Table 1. Sociodemographic characteristics of children with renal diseases (n=148)

Variable		No. (%)			P
		Total (n=148)	Male (n=59)	Female (n=89)	
Age in years, median (IQR)		7.5(4–12)	6(2–10)	8(04–12)	0.179
Age ranges	<5 years	48(32.4)	23(47.9)	25(52.1)	0.095
	5–10 years	47(31.8)	21(44.7)	26(55.3)	
	>10–17 years	53(35.8)	15(28.3)	38(71.7)	
Residence	Urban	83(56.1)	30(36.1)	53(63.9)	0.296
	Rural	65(43.9)	29(44.6)	36(55.4)	

IQR: Interquartile Range.

ever, higher prevalence has been described, too [8, 25, 26]. The low reported prevalence in our study could be due to the low index of suspicion, underdevelopment of the subspecialty in this region, as well as the limited resources to properly investigate for renal disease even when the suspicion is made and the fact that we included only admitted cases.

There are variations in the causes of renal diseases in different parts of the world, and this is most marked between temperate and tropical regions. Even in tropical areas, differences are seen in the pattern of renal diseases. The main factor differentiating renal disease in the tropics from that in temperate regions is the much higher frequency of infectious etiology. We described the pat-

Table 2. Clinical characteristics of children with urinary tract infection (n=76)

Clinical Features	Category	No. (%)
Symptoms	Fever	62(81.6)
	Abdominal pain	39(51.3)
	Vomiting	31(40.8)
	Headache	22(28.5)
	Dysuria	04(5.3)
	Convulsion	03(3.9)
Signs	Anemia	5(6.6)
	Hematuria	01(1.3)
	Failure to thrive	01(1.3)
Severity	Uncomplicated	69(90.8)
	Complicated	7(9.2)
	Immunodepression	4(57.1)
	Age <3 months	3(42.9)
	CAKUT*	1(14.3)

*Posterior urethral valve, n=1.

CAKUT: Congenital Abnormality of the Kidney and Urinary Tract.

Table 3. Clinical characteristics of children with acute kidney injury (n=32)

Clinical Features	Category	No. (%)
Symptoms	Fever	22(68.8)
	Abdominal pain	14(43.8)
	Vomiting	13(40.6)
	Headache	6(18.8)
	Convulsion	3(9.4)
Signs	Oligoanuria	18(56.3)
	Hematuria	12(37.5)
	Edema	12(37.5)
	Hypertension	11(34.4)
	Jaundice	6(18.8)
Severity (KDIGO)	Stage 1	03(9.4)
	Stage 2	02(6.3)
	Stage 3	27(84.4)
Etiology	Malaria	13(40.6)
	Sepsis	13(40.6)
	Post-infectious GN	05(15.6)
	Blackwater fever	05(15.6)
	HUS	03(9.4)
	Exogenous nephrotoxin*	03(9.4)
Need for dialysis		16(50)
Access to dialysis		14(87.5)
Reasons for no access	Left against medical advice	1
	Death before initiation	1

*Aminoglycoside 2, herbal ingestion 1.

GN: Glomerulonephritis; HUS, Hemolytic Uremic Syndrome.

tern of renal disease to be dominated by UTI, AKI, and nephrotic syndrome.

In SSA, the proportion of UTI among admitted children varies between 3.1% and 41.9% [7, 8, 27] due to environmental, cultural factors, and the definitions used. The preponderance of UTIs in our study could be explained by the fact that most patients who presented with fever were screened for UTI with urinalysis. So, it could be an overestimation resulting from urinalysis for the definitive diagnosis. In agreement with our study, UTI was the most common renal disease reported in certain parts of Nigeria [8, 26-28], Iraq [26], Venezuela [29], and Sudan [30]. We found complicated UTIs in 9.2% of children with UTI with 1 case with CAKUT. Complicated UTIs usually occur in individuals with underlying conditions that increase the risk of treatment failure and renal scarring. Although urologic malformations in children with UTI were uncommon in our study, it was, however, frequent in children in Venezuela [29]. The seldom use of

J Ped Nephrol
Journal of Pediatric Nephrology

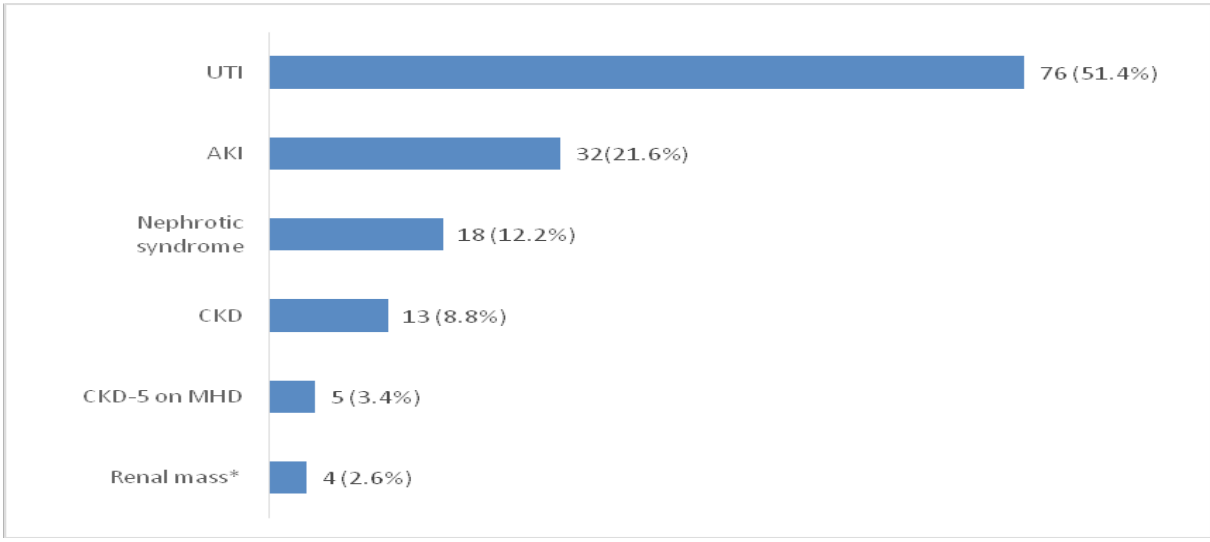

Figure 1. Types of renal disease/syndrome (n=148)

AKI: Acute Kidney Injury; CKD: Chronic Kidney Disease; UTI: Urinary Tract Infection; MHD: Maintenance Hemodialysis; *Undefined 3, Renal lymphoma 1.

ultrasound in our setting for children with complicated UTIs can explain our low findings rate.

AKI (21.6%) was the second most prevalent renal diagnosis, with malaria and sepsis the most common etiologies. In SSA, various infections, especially malaria, is common in children that may lead to AKI, which poses a significant burden associated with high mortality [9, 31]. Our prevalence is comparable with 24.7%, which was reported in Southwest Nigeria, where it was the most common renal disease described [5]. The presence of hemodialysis units in the centers under study increases the rate of referral of AKI from other nearby centers. However, lower rates have been reported in certain parts of Nigeria [15, 27, 28] and other countries [26, 29, 30]. An underestimation of AKI load could explain these variations in the reports as the source of identifying patients in those studies was the inpatient register that lists the pri-

Table 4. Clinical characteristics of children with nephrotic syndrome (n=18)

Clinical Features	Category	No. (%)
Symptoms	Abdominal pain	4(22.2)
	Fever	3(16.7)
	Vomiting	2(11.1)
Signs	Anasarca	18(100)
	Anemia	5(27.8)
	Haematuria	2(11.1)
	Hypertension	1(5.6)
	Oliguria	1(5.6)
Reasons for admission	Initiate therapy	15(83.3)
	Infection	6(33.3)
	AKI	1(5.3)

AKI: Acute Kidney Injury.

Table 5. Clinical characteristics of children with chronic kidney disease (non-dialysis) (n= 13)

Clinical Features	Category	No. (%)
Symptoms	Vomiting	5(38.5)
	Abdominal pain	4(30,8)
	Dyspnoea	4(30.8)
	Fever	3(23.1)
	Dysuria	1(7.7)
Signs	Anemia	10(76.9)
	Hypertension	8(61.5)
	Oedema	8(61.5)
	Oliguria	4(30.8)
	Failure to thrive	2(15.4)
	Haematuria	1(7.7)
Stage	Stage 3	01(7.7)
	Stage 5	12(92.3)
Etiology	Chronic GN	07(53.8)
	CIN	03(23.1)
	CAKUT*	02(15.4)
	HIVAN	01(7.7)
Reasons for admission	Severe anemia	09(75)
	Fluid overload	09(75)
	Uraemia	06(50)
	Hyperkalaemia	01(8.3)
Need for dialysis (CKD-5)		9(75%)
Access to dialysis		5(55.5%)
Reasons for no access	Lack of funds	3
	Death before initiation	1

*Posterior urethral valve n=2.

HIV: Human Immunodeficiency Virus; GN: Glomerulonephritis; CIN: Chronic Interstitial Nephritis; HIVAN: Human Immunodeficiency Virus-Associated Nephropathy; CAKUT: Congenital Abnormality of the Kidneys and Urinary Tract.

mary cause of admission and discharge and not the renal complications that could have been encountered during admission. The majority of the children had severe AKI similar to what was reported in earlier studies in Cameroon [4, 32] and Ivory Coast [33]. This higher proportion of cases with severe AKI could be due to late presentation, diagnosis, and referral to these centers. Although variations exist for the causes of pediatric AKI within countries and across continents, malaria and sepsis, as found in our study, have remained the major causes of AKI in most developing countries.

Nephrotic syndrome has been identified as the most common renal disease in children occurring with variable frequencies. In this study, the nephrotic syndrome was seen in 12.2% of children with renal disease. This

J Ped Nephrol
Journal of Pediatric Nephrology

Table 6. Characteristics of children on maintenance hemodialysis (n= 5)

Variable		No. (%)
Dialysis vintage	Median duration on dialysis, (IQR) months	3(3–17)
Type of vascular access	Temporal CVC	5(100)
Etiology	CGN	3(60)
	CIN	1(20)
	CAKUT*	1(20)
Reasons for admission	Severe anemia	2(40)
	Fluid overload	2(40)
	Uraemia from under-dialysis	1(20)
	Catheter-related infection	1(20)

*Posterior urethral valve, n=1.

CGN: Chronic Glomerulonephritis; CIN: Chronic Interstitial Nephritis; CVC: Central Venous Catheter; IQR: Interquartile Range.

rate is comparable to 11.7% reported in Abuja in Nigeria [8] and 15.9% in Iraq [32]. However, higher rates have been reported in Northeast India (57.5%) [34] and Bangladesh (76%) [35]. This variation in prevalence rates can be due to genetic and environmental factors. Acute kidney injury was described as a reason for admission in 1 (5.5%) child with nephrotic syndrome. A review on the nephrotic syndrome in children in SSA reveals that 16% of children with nephrotic syndrome had renal insufficiency on admission [10]. The lower rate in our study could be due to improvement in the early recognition and management of nephrotic syndrome among healthcare professionals in our setting.

CKD was described in 12.2% of children with chronic glomerulonephritis as the most frequent etiology, and the majority of cases were non-dialysis CKD stage 5. This high figure is comparable to 13.9% reported in Kano in Nigeria [11] but contrasts with reports from eastern Nepal (1.2%) [25], Iraq (6.7%) [26], and some African studies [7, 8, 15]. The presence of chronic parasitic and bacterial infections in the tropics that tend to affect the glomerulus could explain the finding of chronic glomerulonephritis as the primary etiology of CKD. This finding was consistent with earlier reports by Halle et al. in Cameroon [4] and Orta et al. in Venezuela [29]. However, in developed countries, CAKUTs are responsible for the greatest percentage of CKD seen in children, and they are being diagnosed in their earlier stages [8, 26]. Antenatal ultrasounds correctly diagnose CAKUT in 60%–85% of infants, especially if imaging is performed in the third trimester [36]. CAKUTs were rare in our study owing to the lack of antenatal screening in our environment, and parents will tend to seek unorthodox means attributing these abnormalities to supernatural causes. PUV was the only CAKUT seen in our study, with 1 case reported among cases on maintenance hemodialysis. This surgically curable condition of the urologic malformation responsible for CKD raises the problem of low suspicion in case of UTI, inadequate management of these children, and inability to afford surgery.

Regarding discharge, 86.5% of participants were discharged with improvement, 7.4% against medical advice, and 4.7% died, responsible for mortality reported in participants of AKI and CKD. Mortality rates from renal disease in children in SSA vary from 2.9% to 14.4% [7, 8, 22] dependent on the predominant renal diseases, the study population, promptness of presentation at the hospital, awareness about renal diseases, the difference in availability of diagnostic tools, the appropriateness of treatment, and access to free renal healthcare services. Our mortality is comparable to 4.8% reported in Southeast Nigeria [15] but lower than 14.4% reported in Southwestern Nigeria [7]. The relatively low mortality in our study could be explained by the fact that UTI is the most prevalent renal disease in our study, which is amenable to treatment. Also, the presence of dialysis units increased awareness about renal failure, and prompt management of severe cases could explain the low mortality in our setting. The remarkable rate of discharge against medical advice in our study is comparable with findings

from certain parts of Nigeria [8, 28]. This issue is often caused by financial constraints in accessing healthcare services as payment is usually out of pocket for parents/caregivers who seek unorthodox medicine.

Conclusion

Renal diseases are uncommon among admitted children, with most of these cases presenting with non-specific clinical features. UTI, AKI, and the nephrotic syndrome were the most common renal diagnosis seen. Overall mortality was low and seen only in cases with AKI and CKD.

Ethical Considerations

Compliance with ethical guidelines

This study was done following the obtainment of ethical approval and administrative authorization respectively from the Faculty of Health Sciences at the University of Buea (Code: 2020/1074-01/UB/SG/IRB/FHS) and Administration of the Buea and Bamenda Regional Hospitals (Code:1004/MPH/RDPH/RHB/069). To maintain the confidentiality of medical records, we used codes in place of names of case files.

Funding

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

Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declared no conflict of interest.

References

[1] Jha V, Prasad V. CKD and infectious diseases in Asia Pacific: Challenges and opportunities. Am J Kidney Dis. 206; 68(1):148-60. [DOI:10.1053/j.ajkd.2016.01.017] [PMID]

[2] Dirks J, Guisseppe R, Horton S, Schieppati A, Rizvi AH. Diseases of the kidney and the urinary system. In: Jamison D, editor. Disease control priorities in developing countries. Washington (DC): World Bank Publications; 2006. https://www.google.com/books/edition/Disease_Control_Priorities_in_Developing/Ds93H98Z6D0C?hl=en&gbpv=0

[3] Luyckx VA, Tonelli M, Stanifer JW. The global burden of kidney disease and the sustainable development goals. Bull World Health Organ. 2018; 96(6):414-22D. [DOI:10.2471/BLT.17.206441] [PMID] [PMCID]

[4] Halle MP, Lapsap CT, Barla E, Fouda H, Djantio H, Moudze BK, et al. Epidemiology and outcome of children with renal failure in the Pediatric ward of a tertiary hospital in Cameroon. BMC Paediatr. 2017; 17(1):202. [DOI:10.1186/s12887-017-0955-0] [PMID] [PMCID]

[5] Adekanmbi AF, Ogunlesi TA, Fetuga MB, Obadina OO, Adekoya OA. Pattern of renal diseases among hospitalised children in sagamu. Afr J Sci Nat. 2015; 1(1). http://journals.oouagoiwoye.edu.ng/v2/index.php/AJSN/article/view/14

[6] Muoneke VU, Una AF, Eke CB, Anyanwu OU. The burden and outcome of Pediatric renal admissions at the federal teaching hospital abakaliki; A 3-year review (2011-2013). Ann Med Health Sci Res. 2016; 6:243-50. [DOI:10.4103/amhsr.amhsr_342_14] [PMID] [PMCID]

[7] Ladapo TA, Esezobor CI, Lesi FE. Pediatric kidney diseases in an African country: Prevalence, pectrum and outcome. Saudi J Kidney Dis Transpl. 2014; 25(5):1110-16. [DOI:10.4103/1319-2442.139976] [PMID]

[8] Anigilaje E, Adesina T. The pattern and outcomes of childhood renal diseases at University of Abuja Teaching Hospital, Abuja, Nigeria: A 4 year retrospective review. Niger Postgrad Med J. 2019; 26(1):53-60. [DOI:10.4103/npmj.npmj_174_18] [PMID]

[9] Evans RDR, Docherty M, Seeley A, Craik A, Mpugna M, Mann S, et al. Incidence, etiology, and outcomes of community-acquired acute kidney injury in pediatric admissions in Malawi. Perit Dial Int. 2018; 38(6):405-12. [DOI:10.3747/pdi.2017.00253] [PMID]

[10] Olowu WA, Ademola A, Ajite AB, Saad YM. Childhood nephrotic syndrome in tropical Africa: Then and now. Paediatr Int Child Health. 2017; 37(4):259-68. [DOI:10.1080/20469047.2017.1374002] [PMID]

[11] Obiagwu PN, Lugga AS, Abubakar AA. Pattern of renal diseases in children attending Pediatric nephrology clinic of aminu kano teaching hospital, Kano. Niger J Clin Pract. 2019; 22(7):920-5. [DOI:10.4103/njcp.njcp_538_18] [PMID]

[12] Harambat J, van Stralen KJ, Kim JJ, Tizard EJ. Epidemiology of chronic kidney disease in children. Paediatr Nephrol. 2012; 27(3):363-73. [DOI:10.1007/s00467-011-1939-1] [PMID] [PMCID]

[13] Peco-Antic A, Bogdanovic R, Paripovic D, Paripovic A, Kocev N, Golubovic E, et al. Epidemiology of chronic kidney disease in children in Serbia. Nephrol Dial Transplant. 2012; 27(5):1978-84. [DOI:10.1093/ndt/gfr556] [PMID]

[14] Becherucci F, Roperto RM, Materassi M, Romagnani P. Chronic kidney disease in children. Clin Kidney J. 2016; 9(4):583-91. [DOI:10.1093/ckj/sfw047] [PMID] [PMCID]

[15] Okoronkwo NC, Chappjumbo AU, Onyire BN, Ekpemo SC, Ijeoma SN. Pattern of childhood renal diseases in Aba, south east Nigeria. Am J Pediatr. 2020; 6(3):285-91. [DOI:10.11648/j.ajp.20200603.27]

[16] Kumar BH, Krishnamurthy S, Chandrasekaran V, Jindal B, Ananthakrishnan R. Clinical spectrum of congenital anoma-

J Ped Nephrol
Journal of Pediatric Nephrology

lies of kidney and urinary tract in children. Indian Pediatr. 2019; 56(7):566-70. [DOI:10.1007/s13312-019-1556-9] [PMID]

[17] Viswanath D. Nephrotic syndrome in children. J Indian Acad Oral Med Radiol. 2013; 25(1):18-23. [DOI:10.5005/jp-journals-10011-1333]

[18] National Collaborating Centre for Women's and Children's Health (UK). Urinary tract infection in children: Diagnosis, treatment, and long-term management. London: RCOG Press; 2007. [PMID]

[19] Cleto-Yamane TL, Gomes CLR, Suassuna JHR, Nogueira PK. Acute kidney injury epidemiology in pediatrics. Braz J Nephrol. 2019; 41(2):275-83. [DOI:10.1590/2175-8239-jbn-2018-0127] [PMID] [PMCID]

[20] Jung KM, Cho MH. Clinical approach to children with proteinuria. Child Kidney Dis. 2017; 21(2):53-60. [DOI:10.3339/jkspn.2017.21.2.53]

[21] Meyers KEC. Evaluation of hematuria in children. Urol Clin North Am. 2004; 31(3):559-73. [DOI:10.1016/j.ucl.2004.04.015] [PMID]

[22] Abdullahi UI. Pediatric renal diseases in a rural tertiary hospital in north-western Nigeria: Pattern and outcom. J Egypt Soc Nephrol Transplant. 2017. [DOI:10.4103/jesnt.jesnt_34_16]

[23] Albar H. Spectrum and outcome of Pediatric renal diseases in Dr. Wahidin Sudirohusodo hospital Mkassar. Nusant Med Sci J. 2016; 1(2):10-15. [DOI:10.20956/nmsj.v1i2.2212]

[24] Ashraf M, Kumar V, Bano RA, Wani KA, Ahmed J, Ahmed K. Spectrum of renal and urinary tract disorders in Kahmiri children. J Clin Diagn Res. 2016; 10(6):SM01-SM02. [DOI:10.7860/JCDR/2016/20222.7999] [PMID] [PMCID]

[25] Yadav SP, Shah GS, Mishra OP, Baral N. Pattern of renal diseases in children: A developing country experience. Saudi J Kidney Dis Transpl. 2016; 27(2):371-76. [DOI:10.4103/1319-2442.178565] [PMID]

[26] Ali S, Hussien F, Abd Al-Amer H. Profile of renal diseases in Iraqi children: A single-center report. Saudi J Kidney Dis Transpl. 2015;26(3):613-8. [DOI:10.4103/1319-2442.157422] [PMID]

[27] Ezeonwu B, Okike C, Oguonu T, Nwankwo O. Pattern of renal disease in children admitted into the Pediatric ward of federal medical center, Asaba. Afr J Nephrol. 2014; 1(1). https://www.ajol.info/index.php/ajpn/article/view/134631

[28] Garba BI, Muhammad AS, Obasi AB, Adeniji AO. Presentation and pattern of childhood renal diseases in Gusau, northwestern Nigeria. South Afr J Child Health. 2017; 11(2):96-8. [DOI:10.7196/SAJCH.2017.v11i2.1222]

[29] Orta-Sibu N, Lopez M, Moriyon JC, Chavez JB. Renal diseases in children in Venezuela, South America. Pediatr Nephrol. 2002; 17(7):566-9. [DOI:10.1007/s00467-002-0892-4] [PMID]

[30] El-Tigani MAA, Rahman AH, Karrar ZA. Pattern and outcome of renal diseases in hospitalized children in Khartoum state, Sudan. Sudan J Paediatr. 2012; 12(2):52-9. [PMID] [PMCID]

[31] Esezobor CI, Ladapo TA, Lesi FE. Clinical profile and hospital outcome of children with severe acute kidney injury in a developing country. J Trop Pediatr. 2015; 61(1):54-60. [DOI:10.1093/tropej/fmu066] [PMID]

[32] Fouda HD, Teuwafeu DG, Halle MP, Kaze FF, Ashutantan G. Clinical profile and outcome of Pediatric acute kidney injury in Cameroon: Comparison between an urban and a semi-urban health facility. Open J Nephrol. 2018; 8(2):56-64. [DOI:10.4236/ojneph.2018.82007]

[33] Yao KH, Guei MC, Tia WM, Konan SD, Diopoh SP, Sanogo S. Comparative study of community acute kidney injury in young patients versus elderly patients in an internal medicine department in Abidjan (Côte d'Ivoire). J Ren Inj Prev. 2017; 6(3):199-204. [DOI:10.15171/jrip.2017.38]

[34] Sonowal R. Profile of renal diseases in North-East Indian children. Saudi J Kidney Dis Transplant. 2019; 30(5):1151-55. [DOI:10.4103/1319-2442.270272] [PMID]

[35] Qader MA, Uddin GM, Rahman H, Hanif M, Roy RR, Begum A, et al. Diseases in children attending Pediatric nephrology centres of dhaka city. J Paediatr Nephrol. 2016; 4(3):86-91. [DOI:10.22037/JPN.V4I3.12580]

[36] Murugapoopathy V, Gupta IR. A primer on congenital anomalies of the kidneys and urinary tracts (CAKUT). Clin J Am Soc Nephrol. 2020; 15(5):723-31. [DOI:10.2215/cjn.12581019] [PMID] [PMCID]