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ORIGINAL ARTICLE

PATTERN, OUTCOME, AND ASSOCIATED FACTORS OF RENAL DISEASE AMONG HOSPITALIZED CHILDREN AT PUBLIC HOSPITALS IN BAHIR DAR TOWN, NORTH-WESTERN ETHIOPIA

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Abstract

Background: *Renal diseases are major causes of morbidity and mortality in hospitalized pediatric patients. Data on the spectrum of renal disorders and their outcomes are scarce in Ethiopia, in the Amhara region particularly. Hence, this study aimed to assess the pattern, outcome, and associated factors of renal disease among hospitalized pediatric renal patients in the Amhara region, North-west Ethiopia, 2020.*

Methods: *Institution-based review of medical records of renal disease subjects was conducted from September 1-15, 2020. All (107) pediatric patients who were diagnosed and hospitalized with renal disease from January 1/2019 to August 30/2020 were studied. A checklist was used to review medical records. Analysis was done using the SPSS version 23. Descriptive and summary statistics were carried out. Chi-squared test was used to assess the association between dependent and independent variables.*

Result*: Glomerulonephritis was the common cause of renal admissions (59.8%) and 40% of them had renal failure. Multi-organ failure and sepsis were causes of death for 12.1% of patients. Acute kidney injury (X2=4.484, p <0.05), chronic kidney disease (X2=6.617, p< 0.05), multi-organ failure (X2=48.57, p< 0.05), Sepsis (X2=45.29, p< 0.05), hospital stay >2 weeks (X2=23.2, p<0.05), electrolyte abnormalities (X2=17.87, p<0.05), and seizure (X2=45.15, p<0.05) had statistical associations with poor outcome of renal disease.*

Conclusion: *Glomerulonephritis was the common cause of renal admissions. Sepsis and multi-organ failure were common causes of death. The complications, hospital stay >2 weeks, electrolyte*

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abnormality, and seizure had an association with the outcome of renal disease. Hence, this study suggests that early diagnosis and management of renal failures and complications, and shortening hospital stay enhance the outcome of renal disease.

Keywords: Renal disease, associated factors, Public Hospitals, Bahir Dar, Ethiopia.

Introduction

Pediatric nephrology is very challenging and is not a priority in developing countries contrary unlike developed ones. The burden of kidney disease in children in most developing countries including Sub-Saharan Africa (SSA) is unknown and difficult to estimate due to a lack of data on pediatric kidney disease [1, 2]. In developing countries, the major causes of chronic kidney disease(CKD) in children are chronic glomerulonephritis, urologic malformations (posterior urethral valves), and CKD of unknown etiology, while for Acute kidney injury (AKI) septicemia, diarrhea, malaria, and hemolytic uremic syndrome is the most frequent causes [3, 4].

In developed countries, the causes of renal disease are predominantly due to chronic medical illnesses mainly diabetic nephropathy (>53%) and among none diabetic individuals abnormal albumin excretion and glomerulonephritis due to IGA nephropathy are suggested [2]. The percentage of renal-related admissions to secondary and tertiary hospitals in developing countries varies widely from 3.5 to 8.9% among different centers and countries [7, 8]. The most common cause of renal admission in south Africa is AKI due to dehydration and septic shock syndromes [6, 9]. The spectrum of chronic glomerular diseases varies in the different geographical regions of the continent, with infectious agents implicated in its causation [7, 10].

Worldwide, epidemiological information on the incidence and prevalence of pediatric AKI and CKD is limited, often imprecise, and flawed by methodological differences between the various data sources, although increasing in scope. This is particularly pertinent in Africa, where the focus is on communicable diseases with a lack of proper documentation and renal registries [14, 15]. Pediatric patients with renal disease, especially younger ones may present with nonspecific signs and symptoms unrelated to the urinary tract [16]. Kidney disease often goes undetected in the general population, but children and adolescents are at even greater risk due to the nature of the causes of the disease and the ambiguity of the symptoms. Early diagnosis and management are the cornerstones of renal disorders management. [15, 17, 18, 19]. In Ethiopia, Northwest region, evidence on the spectrum of renal disorders and their outcomes are very scarce.

Methods

Study design, setting, and period:

A Hospital-based cross-sectional study was conducted at selected public hospitals, in the Amhara region, North-west Ethiopia, from

September 1-20, 2020. Two public hospitals were used as study settings, namely, Tibebe-Ghion specialized hospital (TGSH) and Felege -Hiwot comprehensive specialized hospital (FHCSH). Tibebe-Ghion specialized hospital (TGSH) which is one of the teaching hospitals in Ethiopia is found in Bahir Dar city. The pediatrics department at TGSH has outpatient and 6 inpatient service units which include emergency ward, critical ward, stable ward, Neonatal Intensive Care Unit/NICU, Pediatric Intensive Care Unit/ PICU, and maternal side. There are 16 senior pediatricians and one sub-specialist cardiologist, 41 residents, and 50 nurses. In the critical and stable ward, there are 44 beds, There is also PICU which has 3 beds with a mechanical ventilator. It is equipped with MRI, and CT in addition to other laboratory and pharmacy services, but there is no dialysis and renal transplantation service in the hospital. Felege-Hiwot comprehensive specialized hospital (FHCSH) is also found in Bahirdar. The pediatrics and child health department has 8 senior pediatricians and has both outpatient (OPD) and inpatient units, The pediatric ward has a total of 52 beds, The hospital has an adult ICU and adult dialysis service but there is no pediatric ICU and pediatric dialysis and renal transplantation center. It has CT and, EEG services in addition to basic diagnostic, laboratory, and pharmacy services.

Population, sample size determination, and sampling procedure

All admitted patients with renal disease at public hospitals in Bahirdar town were the source population. While all admitted patients with the diagnosis of renal disease at randomly selected public hospitals in Bahirdar town from January 1/2019 to August 30/2020 were the study subjects. All pediatric patients admitted with renal disease and aged 1 month to 14 years were eligible for this study. While patients with incomplete documentation and laboratory results were excluded from the study.

Sampling technique and procedures:

Initially, TGSH and FHCSH were selected randomly by lottery method from the available hospitals in the city. Then, all (107) pediatric patients with renal disease who were admitted from January 1/2019 to August 30/2020 were included in this study.

Variables:

There are dependent and independent variables. The dependent variable is renal disease patient outcome (discharge or death). The Independent variables include; Socio-demographic characteristics (age, sex, and residence), Presence of complications, causes of renal disease, clinical presentation, type of treatments, and need for renal replacement.

Data collection:

Data were collected at TGSH and FHCSH from medical records (log book and patient charts) of patients admitted at the pediatric ward and pediatric intensive care unit (PICU) for in-patient management from January 1/2019 to August 30/2020. Data were collected by four trained medical interns/ Practitioners.

There was daily supervision of the data collection process including its completeness by the two supervisors. A semi-structured checklist that contains demographic data of the children with renal disease, causes, and major outcomes of renal disease were used to collect the data. The checklist was pre-tested before the actual data collection was started.

Measurements:

Renal disease; any disease which affects the renal system structurally or functionally, can be the renal or extra-renal cause [14].

Renal Disease Outcome: hospital discharge condition of study subjects (discharged alive or dead).

Discharge from the hospital: includes (discharge improved, discharge against, referred for dialysis or transplantation, surgical intervention, and further workup).

Acute renal failure: impaired renal function in less than 3 months as defined by PRFILs criteria during the initial visit to the hospital and retrieved from the patient chart

Chronic renal failure: decreased renal function which stays more than 3 months defined by eGFR <60ml/m^2 during the initial visit to the hospital and retrieved from the patient chart

Improved: discharged from the hospital without complication

Complications; the presence of renal failure multi-organ dysfunction i.e (pulmonary edema, heart failure, uremia), electrolyte abnormalities, sepsis**.**

Statistical Analysis:

The collected data were entered and cleaned using SPSS statistical software version 23. Data cleaning by running frequencies of all the variables to check for incorrect coding and missing values. Descriptive and summary statistics were carried out. Bivariate and multivariate analysis was carried to assess associations between dependent and independent variables. A chi-square test was carried out to assess the association between independent and dependent variables (outcomes of renal disease) to ascertain univariate association.

Results

Socio-demographic characteristics of participants

From a total of 135 admitted patients, 107 patients fulfilled the eligibility criteria. Twenty-eight charts were excluded because of incompleteness. From a total of 107 renal patients admitted to the pediatric wards, 59 were males (55.1%) and 48 were females (44.9%), giving a male-to-female ratio of 1.2:1. The age of patients ranges from 46 days to 14 years. Nearly half (46.7%) of the participants were between 5-10 years (Table 1).

Table 1: Socio-demographic characteristics of pediatric renal patients admitted at TGSH and FHCSH (N=107), North-west Ethiopia, 2020.

Variables	Category	Frequency(n)	Percentage (%)
Sex	Female	48	44.9
	Male	59	55.1
Age	<5yrs	24	22.4
	5-10yrs	50	46.7
	11-14yrs	33	30.8
Residence	Rural	89	83.2
	Urban	18	16.8
Hospital	TGSH	47	43.9
	FHCSH	60	56.1

Clinical profile, Clinical features, ultra-sound result of patients with renal disease:

Out of 107 patients with renal disease, glomerulonephritis accounts for 64(59.8%) of patients and 19(30%) patients had evidence of acute post-streptococcal glomerulonephritis and 25 (40%) of patients had renal failure. The 2nd most common renal diagnosis was nephrotic syndrome 9(8.4%). The majority of patients 8 (95%) had proteinuria and edema. The 3rd most common renal disease was a congenital anomaly of kidney and urinary tract (CAKUT) (6.5%); the posterior urethral valve was the commonest accounting 3(49%) of the CAKUT. Chronic kidney disease (CKD) accounted also the 3rd cause of renal disease 7(6.5%) and the most common causes were chronic glomerulonephritis 3(49%); four of CKD patients died because of multi-organ failure and sepsis.

AKI was also responsible for 6 (5.6%) and the most common causes were rapidly progressive glomerulonephritis 4(67%) and 5 of the Acute kidney injury (AKI) patients were referred for dialysis. One patient with Hemolytic Uremic Syndrome/HUS died because of multi-organ failure. Other causes of renal disease accounted for 14(13.1%) study subjects; Urinary tract infection/UTI for 6(43%) study subjects. Other causes were sepsis (4), Hemolytic uremic syndrome (HUS) (1), Henoch Schoenlein purpura (HSP) nephritis (1), and Wilms tumor (2). Regarding the Clinical profile, edema was the commonest 84(78.5%) followed by decreased urine output/UOP in 65(60.7%) of the cases. proteinuria was the most common laboratory abnormality among patients with renal disease 91(85%) followed by hematuria 64 (59.8%) and elevated renal function 54 (49.5%) (Table 2).

Table 2: Causes of renal disease and Clinical feature among pediatric renal patients admitted at TGSH and FHCSH (N=107), North-west Ethiopia, 2020.

Clinical features	**Category**	**Responses**	
		Frequency (No)	Percent of cases
Causes of renal disease	Glomerulonephritis	64	59.8
	Nephrotic syndrome	9	8.4
	CAKUT	7	6.5
	CKD	7	6.5
	AKI	6	5.6
Laboratory finding	Proteinuria	91	85
	Hematuria	64	59.8
	Elevated renal function	54	50.5
	Elevated ASO	19	17.8
	Edema	84	78.5
	Decreased UOP	65	60.7
	HTN	53	49.5
Clinical profile	Associated symptoms	52	48.6
	Body rash	32	29.9
	Urinary symptoms	19	17.8
	Seizure, decreased mentation	13	12.1

Regarding the ultrasound result, from 107 patients 44 (41.1%) of them had abnormal ultrasound result and the most common abnormality was parenchymal renal disease 32(29.9%)

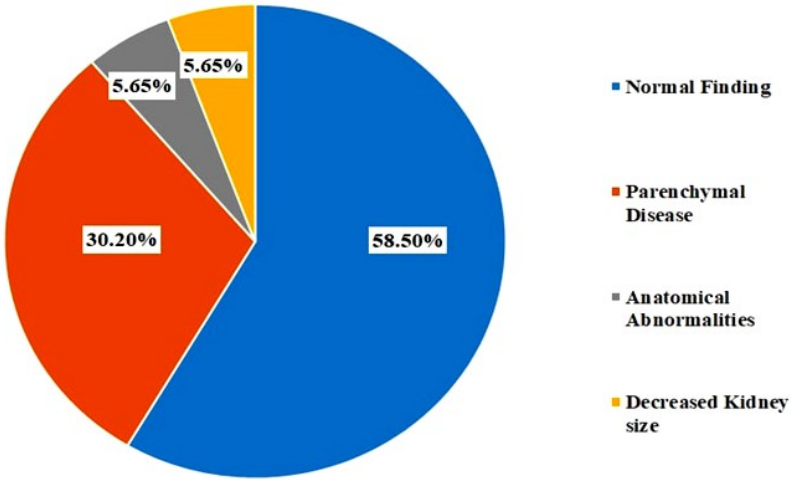

Figure 1: Ultrasound results among pediatric renal patients admitted at TGSH and FHCSH (N=107), North-west Ethiopia, 2020.

Complications, treatments, length of illness, and a hospital stay of pediatric renal patients

Renal failure was the most common complication of renal disease 54(89.5%) followed by electrolyte abnormality 20 (32.8%). Sepsis, heart failure, uremia, multi-organ failure, and pulmonary edema were the other complications. Of 107 patients 79(73.8%) improved and discharged with medical treatment only and 25(23.4%) patients required dialysis and renal transplantation in addition to medical treatments and none of the patients received this treatment. Three(2.8%) of the study subjects required surgical interventions. Sixty-five patients (60.7%) stayed less than one week in the hospital. Fifty-one (47.7%) of patients had a duration of illness of less than one week (Table 3).

Table 3: Complications, treatments, length of illness, and hospital stay among pediatric renal patients admitted at TGSH and FHCSH (N=107), North-west Ethiopia, 2020.

Variables	Category	Responses	
		n	Percent of cases
Complications	Renal failure	54	89.5%
	Electrolyte abnormality	20	32.8%
	Sepsis	19	31.1%
	Heart failure	14	23.0%
	Multi-organ failure	13	21.3%
	Uremia	12	19.7%
	Pulmonary edema	5	8.2%
Treatments provided	Medical only	79	73.8%
	Medical, dialysis, transplantation	25	23.4%
	Surgical intervention	3	2.8%
Length of illness	<1 week	51	47.7%
	1week -3monthss	35	32.7%
	>3months	21	19.6%
Hospital stays	< 1 week	65	60.7%
	1-2 weeks	25	23.4%
	2 weeks	17	15.9%

Treatment outcome of pediatric renal patients

Of the total 107 included subjects, Ninety-four (87.95%) were discharged alive and 13 (12.1%) died. The most common cause of death was a multi-organ failure (6) followed by multi-organ failure and sepsis (5), and sepsis (2). All the deaths needed renal replacement therapy and none of the patients received renal replacement therapy.

Factors associated with the outcome of pediatric patients with renal disease

Pearson's chi-squared test was carried out to assess the presence of an association between different independent variables and renal disease outcomes. There was evidence of a significant association between the presence of AKI (X^2=4.484, p <0.05), the presence of CKD (X^2=6.617, p < 0.05), the presence of complications (X^2=11.15, p <0.05), decreased UOP (X^2 =6.618,p<0.05), electrolyte abnormality (X^2=17.87, p<0.05), multi-organ failure (X^2=48.57, p< 0.05), sepsis (X^2=45.29,p < 0.05), heart failure (X^2=14.23, p< 0.05), uremia (X^2=50.01, p<0.05), seizure or decreased mentation (X^2=45.15, p<0.05), hospital stay> 2weeks (X^2=23.2, p < 0.05). Age, sex, address of patients, and the hospital where patients were treated had no association. Although the most common laboratory finding of pediatric patients with renal disease was proteinuria there was no association with the outcome of renal patients (Table 4).

Table 4: Chi-square (X^2) test showing the association between factors and outcome of pediatric renal patients admitted at TGSH and FHCSH (N=107), North-west Ethiopia, 2020.

Variable		Renal disease outcome		Chi-square	P value
		Death	Discharged		
Age:	less than 5yrs	1	23		
	5-10yrs	8	42		
	11-14yrs	4	29	2.127	.345
Sex	female	4	44		
	Male	9	50	1.188	.276
Residence	rural	11	78		
	Urban	2	16	.0222	.882
Chronic kidney disease	No	10	90		
	Yes	3	4	6.617	.010
Acute renal failure	No	4	58		
	Yes	9	36	4.484	.034
Complication	No	0	46		
	Yes	13	48	11.159	.001
Proteinuria	No	2	14		
	yes	11	80	.002	.963
Multi-organ failure :	No	0	94		
	yes	13	0	48.537	≤ .001
Presence of decreased UOP	No	1	41		
	Yes	12	53	6.181	.013
Seizure and decreased mentation:	No	4	90		
	Yes	9	4	45.173	≤.001
Uremia:	No	4	91		
	yes	9	3	50.012	≤.001
Heart failure:	No	7	86		
	Yes	6	13	14.230	≤.001
Electrolyte abnormality:	No	5	82		
	yes	8	12	17.875	≤.001
Sepsis:	No	2	86		
	Yes	11	8	45.294	≤.001
Hospital stay:	< 1week	4	61		
	1-2 weeks	1	24		
	>2weeks	8	9	23.155	≤.001

Discussion

The study was done to determine patterns, outcomes, and factors associated with pediatric renal disease. The most common renal disease requiring hospital admissions in this study was glomerulonephritis 64 (58.9%) with evidence of acute post-streptococcal glomerulonephritis 19 (30%) of patients and 25(40%) of patients had renal failure. This finding is higher than the report from a study done in Nepal [12]. The high number of these cases may be due to environmental factors, the high number of referrals when patients had complications for ICU, and dialysis treatment need though there was no dialysis service in our study settings.

The second most common renal disease in this study was nephrotic syndrome, which was observed in 9 (8.4%) of the cases. This result is comparable to studies from Latin American studies [19] and Nigerian study [20]. However, lower than a report from Turkey, Addis Ababa Ethiopia, and Bangladesh study [5, 15, 16]. This may be due to the difference in the study period and the improvement of early diagnosis and management of pediatric patients in the late 21st century.

The third causes of renal diseases (chronic renal disease and CAKUT) and fourth causes of renal diseases (acute kidney disease) as an initial diagnosis are responsible for 7(6.5%) and 6(5.6%) of the cases respectively.. The most common cause of AKI was rapidly progressing glomerulonephritis 4(64%) and APSGN. This finding is lower than reports from Tikur Anbesa hospital-Ethiopia, and Latin America [15, 19] but higher than the Zamfaran state study from Nigeria and Nepal study [14, 20]. Three of the CKD subjects had died due to a lack of renal replacement therapy. [10].

PUV was the leading cause of CAKUT accounting for 3(49%) of the cases. This finding is lower than a report from Tikur-Anbessa where it is the most common renal diagnosis This may be because Tikur-Aneesa is the national referral center. Four(64%) of our patients with CAKUT were also referred for further workup and surgical intervention. Other causes were responsible for 14(13%) of the cases and UTI was responsible for the majority.. This finding contradicts the study done in Nigeria's two states [18, 20].

The majority of the patients in this study were males 55.1% from rural areas and aged 5 and 10 years. There was no association between sex, age, address, and e outcome of renal disease. This is comparable to other studies [8, 18]. Proteinuria was the most common laboratory abnormality. . This finding is consistent with the Bangladesh study [5, 18].

This study showed that the presence of complications (sepsis, uremia, heart failure, multiorgan dysfunction), seizure or decreased mentation, decreased UOP, prolonged hospital stay, electrolyte abnormality, AKI, and CKD were associated with the death of patients with renal disease. It is consistent with the study done in Nepal and other developing countries [8, 11, 12]. More than one-tenth of the renal

patients died with the most common cause of death being multi-organ failure and sepsis. This finding is higher than reports from other centers [6, 21, 22]. This might be related to our treatment modalities where all of the deaths needed renal replacement therapy at least temporarily and none of our studies subjects the care.

Conclusion

The most common cause of renal admission in our setup was glomerulonephritis secondary to post-infectious acute glomerulonephritis and renal failure was the most common complication found in this study. Sepsis and multi-organ failure were the most common causes of death. All the deaths had indications for renal replacement therapy and none received the therapy. Acute kidney injury, chronic kidney disease, the presence of complications, decreased UOP, prolonged hospital stay, electrolyte abnormality, seizure, or decreased mentation were associated with the death of patients with the renal disease with a chi-square test.

Declarations

Ethical Consideration:

A letter of Ethical approval was obtained from Bahirdar University Research Ethics Review Committee. Further permission was obtained from the medical director's office and the pediatrics department of the selected hospitals for the utilization of medical records. Confidentiality was maintained by excluding names or other personal identification from the data collection record sheet.

Competing interest

The authors declare that there are no competing interests.

Authors Contribution

YT was involved in conceiving, designing, and implementing the study, designing the questionnaire, data collection, statistical analysis, and manuscript drafting. YA and ZS were taking part in implementing the study, statistical analysis, and manuscript preparation.

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