

Original Article

Assessment of Clinical Spectrum of Renal Diseases in children – A Descriptive Study at Benazir Bhutto Hospital, Rawalpindi

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^{1,3} Experimentation/Study conduction
^{1,2,3} Analysis/Interpretation/Discussion
^{2,3} Manuscript Writing
^{1,3,4} Critical Review
^{2,4} Facilitation and Material analysis

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Abstract

Introduction: Childhood kidney diseases are a frequent presentation. Most of the affected pediatric populations are from under-developed and developing countries. Noting the epidemiology of childhood renal diseases is very important as it helps in health planning, allows for adequate resource allocation, and enables adequate renal services provision. This study aimed to determine the etiological spectrum of renal disease in pediatric patients.

Material and Methods: A descriptive study was conducted in Benazir Bhutto Hospital, Rawalpindi over a period of 6 months. Ethical clearance was taken from the institutional review board and written informed consent was administered before enrollment of subject per study criteria. A total of 100 children of both genders, aged up to 12 years with the diagnosis of any renal disease condition were included in the study. Patients having other comorbidities like chronic liver disease and heart diseases were excluded. The study information includes age, sex, detailed history, physical examination, and details of laboratory investigations. Statistical analysis was conducted in SPSS version 21.

Results: Mean age of patients was 2.1 years. Most patients had a fever, edema, burning micturition, and high blood pressure. In two-thirds of the children RFTs were deranged and 19.0% had positive urinary culture reports. The common kidney diseases were UTI (42.0%), nephrotic syndrome (29.0%), acute kidney injury/ disease (19.0%), and chronic kidney disease (6.0%).

Conclusion: UTIs and nephrotic syndrome along with acute kidney injury were the main kidney conditions. Females were more likely to have UTIs whereas nephrotic syndrome was common in male children.

Keywords: Epidemiology, Kidney diseases, children, presentation.

Introduction

Kidney disease is a global public health problem that affects more than 750 million persons worldwide.¹ The burden of kidney disease varies substantially across the globe, as does its detection and treatment.

Renal disorders contribute a lot to childhood morbidity and mortality in underdeveloped and developing countries. The epidemiology of childhood renal diseases is important because it assists in health planning, allows for adequate resource allocation, and enables adequate renal services provision.^{2,3,4}

The spectrum of kidney diseases is diverse including Acute kidney injury (AKI), urinary tract infections (UTI), acute and chronic glomerulonephritis syndrome, nephrotic syndrome, renal stones, congenital structural malformations, etc. Evidence suggests that around 40% of patients who recover from AKI have persistent renal dysfunction and many develop CKD.⁵ In those with pre-existing CKD, infections often accelerate the rate of progression and may lead to end-stage renal disease (ESRD).

A study from Nigeria reported a prevalence of 3.8% of renal diseases in children, out of which UTI and nephrotic syndrome were the most common causes. In their study there was a progressive increase in the diagnoses of renal diseases, from 3.1% in 2013 to 5.4% in 2016.⁶ Another study from India reported 1.5% of the total admitted patients with renal diseases and UTI and AKI as the most common causes.⁷ A local study from Karachi witnessed that in 42% of the total admitted patients with renal diseases, nephrotic syndrome was the most common cause.⁸ Paediatric nephrology is challenging in developing countries and data on the burden of kidney disease is difficult to estimate due to the absence of renal registries. Constant attempts to generate an evidence base regarding these rising kidney complications in the paediatric population are necessary. This study was planned to determine the etiological spectrum of renal disease in paediatric patients.

Materials and Methods

This descriptive study was conducted in the pediatric department of Benazir Bhutto Hospital, Rawalpindi for a period of six months from July 2019 to December 2019. The original estimated study sample was 87 cases however, 100 patients were enrolled using non-probability consecutive sampling. Ethical approval

was taken from the hospital ethics committee vide letter no. R-33/RMU dated 1-6-2019.

Patients and definitions

Children of both genders, aged up to 12 years with the diagnosis of any renal disease condition were included in the study. Patients having other comorbidities like chronic liver disease and heart diseases were excluded from the study.

Acute kidney injury/disease was defined as an estimated creatinine clearance decrease by 50% and/or urine output < 0.5 ml/kg/hour for 16 hours.⁹

Urinary tract infections were considered as isolation of a bacterium in the urine sample obtained via suprapubic aspiration or at least 50 000 colony-forming units (CFU) per mL of a uropathogen in urine obtained via catheterization or the presence of $\geq 100,000$ CFU per mL of a uropathogen from a mid-stream urine sample.⁶

Nephrotic syndrome was considered as the presence of edema, massive proteinuria >3.5 gm/24 hours or urine protein: creatinine ratio of ≥ 2 and hypoalbuminemia ≤ 2.5 g/dl and hyperlipidemia (cholesterol >200mg/dl).¹⁰

Acute glomerulonephritis was defined as to include hematuria, hypertension, edema, oliguria, and varying degrees of renal insufficiency.⁶

Chronic kidney disease was considered as any kidney damage lasting for at least 3 months with or without a decrease in GFR or any patient who has a GFR <60 ml/min/1.73 m² for 3 months with or without kidney damage.⁶

Congenital malformations of the urinary tract were considered as any condition such as a posterior urethral valve (PUV), renal dysplasia, and pelvic-ureteric junction (PUJ) obstruction were diagnosed by micturition cystourethrogram (MCUG), ultrasound scan (USS), and intravenous urography (IVU).⁶

Data Collection:

Data collection was started after taking approval from the hospital ethical committee and informed written consent was taken from parents or caretakers. All children meeting inclusion criteria were selected for the study. Study information included age, sex, detailed history, and physical examination, and laboratory investigations relevant to the renal disease. The diagnosis of acute or chronic kidney disease and its etiology were made as per operational definitions. A structured proforma was designed to collect all relevant information.

Statistical analysis:

Data were managed and analyzed in SPSS software version 21. For the qualitative data like gender, different renal diseases, percentages, and frequencies

were measured. The quantitative variables like age, age at the time of diagnosis were presented as mean and standard deviation.

Results

The mean age of patients was 2.1 years and most of them were older than 5 years of age 39 (39.0%) than those less than 2 years of age. Males and females were equally distributed in the study (49.0% versus 51.0%) respectively. The mean duration of kidney disease in this study patients were 4.1 years ranging from 1 month to 12 years. Physical examination revealed that most of the patients 53 (53.0%) had a fever. Other frequent signs and symptoms were edema 44 (44.0%), burning micturition 27 (27.0%) and high blood pressure 18 (18.0%). Further details can be seen in Table 1.

When the laboratory investigations were quantified, it was noted that two-thirds (67.0%) of patients had abnormal urinary routine examination most of them having pus cells, proteinuria, and RBCs/WBCs. Similarly, RFTs were found deranged in 67 (67.0%) cases. There were 19 (19.0%) patients with positive urine culture reports and the most common pathogen found was E-coli. Average cholesterol was high 244.1 mg/dl. The mean GFR was 8.7 ± 4.3 and the P/C ratio was 4.2 ± 2.3 . Ultrasound findings were normal in the majority 78 (78.0%) cases. There were 22 (22.0%) patients with abnormal findings with the most frequent being hydronephrotic kidneys (4.0%), bilateral kidney disease of grade 1 or 2 (4.0%), RPD (4.0%), and echogenic kidneys (3.0%). Further details regarding laboratory findings can be seen in Table 2 and Figure 1.

In this study, the common kidney diseases were UTI (42.0%), nephrotic syndrome (29.0%), and acute kidney disease (19.0%) The other frequent causes were chronic kidney disease (6.0%), congenital nephrotic syndrome (2.0%) and ectopic kidney (1.0%). (Table 3). No patient with acute glomerulonephritis was diagnosed during this study period.

Further analysis was conducted to see the distribution of kidney diseases according to age and gender. It was noted that there were variations in kidney disease according to age as well as gender. Nephrotic syndrome and the steroid-dependent nephrotic syndrome were more common in male children above 2 years of age whereas UTIs were more frequent in male children below 2 years (p-value, 0.005). Similarly, acute kidney injury was significantly greater in male children below 2 years. In females, the nephrotic

syndrome was more common in patients between 2.1 and 5 years and those above 5 years of age. Acute kidney disease was more frequent in younger girls. UTIs were found significantly more in females between 2.1 to 5 years and those above 5 years (p-value, 0.01). Within two genders it was noted that nephrotic syndrome was significantly more common in males whereas UTIs were more common in females. Further details can be seen in Table 4.

The study outcomes on breakfast practices showed 81.4% (311) were taken breakfast while breakfast skippers were 18.6% (71). 66.7% (255) were taking breakfast daily out of which 62.8% take breakfast within one hour after wakeup, 42.9% had breakfast after 1-2 hours before the start of class. 84.6% were used to do breakfast at home, 27.5% said they take samosa once they skip breakfast. (Table 2)

61 females and 10 males were among the breakfast skippers. (Table 3)

Factors associated with skipping breakfast in medical students are shown in Table 4 & Figure 1.

Regarding the factors or reasons for skipping breakfast, it was noticed that 50.7% were running shortage of time, 29.6% have dietary issues like nausea, vomiting, or diarrhea, 5.6% were having an aim to lose weight and 14.1% were having multiple reasons. There was no significant association ($p > 0.05$) between gender-based comparison for the reasons or factors (to lose weight, due to shortage of time, due to nobody being available to prepare breakfast, medical issues like nausea, vomiting, diarrhea, etc and multiple Reasons) to skip breakfast. (Table 5)

Table 1: Baseline and clinical characteristics of patients (n=100)

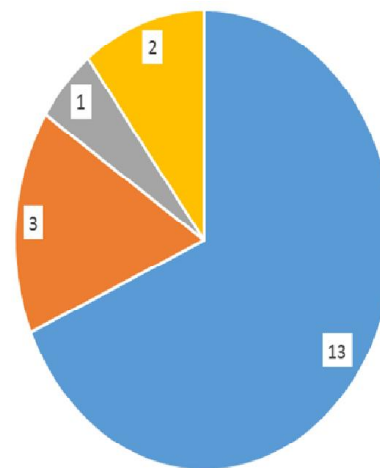
	No of cases	%age
Baseline characteristics		
Age (years)		
Up to 2	30	30.0%
2.1 to 5	31	31.0%
5.1 or above	39	39.0%
Mean \pm SD	2.1 \pm 0.8	
Gender		
Male	49	49.0%
Female	51	51.0%
Clinical characteristics		
Duration of disease		
Mean \pm SD	4.1 \pm 2.2	
Fever	53	53.0%
Burning micturition	27	27.0%
Edema	44	44.0%

Decreased urinary output	22	22.0%
Hypertension	18	18.0%
Abdominal pain	3	3.0%

Pericalyceal thickness	2	2.0%
PUJ obstruction	1	1.0%
Ectopic kidney	1	1.0%

Table 2: Laboratory findings of patients (n=100)

	No of cases	%age
Urinary R/E		
Normal	33	30.0%
Abnormal (pus cells, proteinuria, RBC/WBCs)	67	31.0%
Urine cultures		
Positive	19	19.0%
Negative	81	81.0%
RFTs		
Normal	33	33.0%
Deranged	67	67.0%
GFR		
Mean \pm SD	8.7 \pm 4.3	
P/C ratio		
Mean \pm SD	4.2 \pm 2.3	
Urinary albumin		
Mean \pm SD	2.2 \pm 0.6	
Serum cholesterol		
Mean \pm SD	266.1 \pm 147.1	
Ultrasound findings		
Normal	78	78.0%
B/L grade 1 or 2 kidney disease	4	4.0%
Hydronephrotic kidneys	4	4.0%
RPD	4	4.0%
Echogenic kidney	3	3.0%
Cystitis	2	2.0%



■ E-coli ■ Morganella Morganii ■ Klebsiella ■ Pseudomonas

Figure 1: Frequency of microorganisms found on urinary cultures

Table 3: Type of kidney diseases in the study (n=100)

	No of cases	%age
UTI	42	42.0%
Nephrotic syndrome	29	29.0%
Acute Kidney Injury/Disease	19	19.0%
Chronic Kidney Disease	6	6.0%
Congenital causes (congenital nephrotic, ectopic)	3	3.0%

Table 4: Comparison of type of kidney diseases according to age and gender (n=100)

Gender	Type of kidney diseases	Up to 2 years (n=17)	2.1-5.0 years (n=17)	5.1 or above (n=15)	p-value
Male	AKI/AKD	8 (47.1%)	2 (11.8%)	3 (20.0%)	0.005
	CKD	0 (0.0%)	1 (5.9%)	3 (20.0%)	
	Congenital nephrotic syndrome	0 (0.0%)	0 (0.0%)	1 (6.7%)	
	Nephrotic syndrome	3 (17.7%)	12 (70.6%)	6 (33.4%)	
	UTI	6 (35.3%)	2 (11.8%)	3 (20.0%)	
Female	AKI/AKD	6 (46.2%)	0 (0.0%)	1 (4.2%)	0.01
	CKD	0 (0.0%)	1 (7.1%)	1 (4.2%)	
	Ectopic kidney	0 (0.0%)	1 (7.1%)	0 (0.0%)	
	Congenital nephrotic syndrome	1 (7.7%)	0 (0.0%)	0 (0.0%)	
	Nephrotic syndrome	1 (7.7%)	4 (28.6%)	4 (16.7%)	
	UTI	5 (38.5%)	8 (57.1%)	18 (75.0%)	

Discussion

Kidney diseases present in up to 10% of paediatric populations worldwide. The spectrum of renal diseases varies by ethnic, geographic, and environmental background.¹¹ Evidence generation to monitor the demographic and clinical spectrum of the disease can help in proper management and avoidance of critical renal conditions. This study assessed the pattern of kidney diseases in children presenting to a tertiary care setting. In this study, urinary tract infections were the most common kidney issue followed by nephrotic syndrome, acute kidney diseases, and acute kidney injuries.

In the present study, urinary tract infection was the most common kidney disease. It was noticed that among the two genders UTI was more common in females, especially between the ages of 5 to 12 years. A previous study by Salarzei M et al witnessed a similar trend, they found that majority of children of both genders above 2 years suffered from UTIs.¹² Another study by Lo DS et al also witnessed more than 70% of females cases having UTIs with a median age of 2.6 years.¹³ Magliano E and colleagues also reported that the majority (59.0%) of children with UTI were females and the trend was similar in adult women too.¹⁴ This finding has been proven before as well and our study validated it in the local settings once again.

In the present study, the second frequent kidney complication was nephrotic syndrome (29.0%), it was noticed that male children between 2 and 5 years were the main sufferers. Yadav SP et al (26.1%) and Etuk et al (30.7%) reported a similar frequency of nephrotic syndrome in their studies.^{15,16} Malla et al and Etuk et al also noticed that male children below 5 years were suffering from NS the most.^{16,17} These findings are similar to the current study results. Evidence and experience suggest that for nephrotic syndrome the age of presentation is mostly below 10 years.

Acute kidney disease/acute kidney injury was the third most frequent renal complication in this study (19.0%). Other investigators have also witnessed acute kidney injury to be quite frequent in their trials. Yadav SP and colleagues witnessed AKI in 18.1% of cases.¹⁵ The causes of an acute kidney injury have been previously reported to be dehydration, poisoning, insect bites and obstructive uropathy, however, in the current study we did not collect the etiological information from these children.

The prevalence of chronic kidney disease and congenital malformations was also significant (6% and 3%, respectively). These are in comparison to many

previous trials on kidney-related diseases.¹⁸ To avoid chronicity of kidney diseases, it is very important to screen and filter these conditions early on so that minor and early level infections may not transform into a chronic form.

The clinical examination revealed edema, fever, and burning micturition as the most common presentations in the current study patients. A previous study by Malla et al also witnessed edema and fever as main symptoms along with hypertension.¹⁷ Another study by Yadav and colleagues also witnessed that clinically edema, oliguria, hematuria, and fever were the main features.¹⁵ The classic clinical signs and symptoms do remain the same in children and there is no much variation in this regard.

The pathological results of almost all children were deranged. Urine routine examination and RFTs were abnormal in two-third of cases. The mean urinary albumin level was 2.2 mg/dl whereas GFR was 8.7. There were 19% cases of positive urine culture and E-coli being the most common pathogenic cause and morganella morganii and pseudomonas as other frequent bacterial pathogens in this study. Many others have also found E-coli as the most common etiological cause of bacterial infections related to kidney diseases such as UTI. The finding of e-coli infection's predominance in kidney diseases correlates with many international studies. Vranic SM and colleagues from Bosnia reported e-coli as being the predominant pathogen of UTIs.¹⁹ A study from France by Neuzillet Y et al witnessed a similar trend.²⁰ Another study by Abduszaimovic A and colleagues also reported e-coli as the main causative factor of urinary infections.²¹

As the paediatric population remains at increased and frequent risk of UTIs and other kidney infections, continuous monitoring and observations must be generated from time to time using rigorous research methods. To understand the spectrum of kidney diseases and address these complications timely, studies should be done and evidence generated on regular basis. Timely diagnosis and appropriate management is the right path towards tackling kidney infections in children so that they may not develop into chronic condition or advance conditions such as kidney failure.²² As the advanced conditions are related to access to health and high costs of treatment.

This study has many advantages; firstly, it is one of the few attempts in the local setting collection information regarding trends of kidney diseases. Secondly, details of clinical, pathological findings were available.

There were few limitations of the study as well which were mainly related to its observational design. Only baseline information was gathered and any treatment and outcome-related data were not collected.

Conclusion

Kidney diseases are quite common in children presenting to this health care setting. UTIs and nephrotic syndrome along with acute kidney injury are the main types of kidney conditions. Females of the older pediatric age group were more likely to have UTIs whereas nephrotic syndrome was common in male children between 2 and 5 years of age. Fever and edema were the main clinical features. Deranged pathological findings and E-coli as the main bacterial pathogen were witnessed.

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