Research Article

J Ped. Nephrology 2016;4(3):86-91
http://journals.sbmu.ac.ir/jpn

Renal Diseases in Children Attending Pediatric Nephrology Centers of Dhaka City

How to Cite This Article: Qader A, Muin Uddin G, Rahman R, et al. Renal Diseases in Children Attending Pediatric Nephrology Centers of Dhaka City. J Ped. Nephrology 2016;4(3):86-91.

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Received: July-2016
Revised: Aug-2016
Accepted: Sep-2016

Introduction: Renal diseases in children can be congenital or acquired. In Bangladesh, pediatric nephrology care is available for last 2 decades, but there was no epidemiological study to see the pattern of renal diseases in children of the country. So, this study was carried out to observe the pattern of renal diseases in children of pediatric nephrology centers of Dhaka city.

Materials and Methods: The children aged 1 day to 18 years with renal problems attended at selected four pediatric nephrology centers of Dhaka city (BSMMU, DMCH, DSH and NIKDU).

Results: Among 6453 patients, 1123 were admitted in IPD and 5330 were visited at OPD. Mean age was 5.8±3.5 years in IPD patients and 6.90±1.37 years in OPD patients. In IPD among 1123 patients, 720 (64.1%) were male and 403 (35.8%) were female and in OPD among 5330 patients 3336 (62.59%) were male and 1994 (37.4%) were female. Nephrotic Syndrome (76% in IPD and 74% in OPD) was the most common disease followed by chronic kidney disease (CKD 6%) in IPD and urinary tract infections (UTI 9.4%)in OPD were the next common disease. Common presentations were proteinuria (27.6%), oliguria or anuria (26.2%) and edema (25.7%).

Conclusions: The current pattern of renal diseases shows, that the most common renal diseases are NS followed by CKD and UTI. In the study male patients are more common than female.

Keywords: Nephrotic Syndrome; Chronic Kidney Disease; Congenital Anomalies of Kidney and Urinary Tract; Acute kidney Injury.

Running Title: Renal Diseases in Dhaka City

Introduction

The pattern of pediatric kidney diseases varies according to genetic, racial, environmental differences as well as geographical locations. Spectrum of pediatric renal diseases start from Congenital Anomalies of Kidney and Urinary Tract (CAKUT) such as obstructive uropathy and other congenital urological manifestations to acquired kidney disorders such as Glomerulonephritis, renal stone diseases and urinary tract infections [1]. Children with congenital disorders of urinary tract have a slower progression to Chronic Kidney Disease (CKD) in comparison with Glomerulonephritis, resulting in lower proportion of CAKUT in the ESRD population, compared to less advanced stages of CKD [2]. Epidemiological studies from India shows obstructive uropathy and other congenital urological malformations was the common cause of CKD [3, 4].

Similar results were also reported from Pakistan, 28% were congenital anomalies and the main cause of CKD in children [5]. Common renal diseases in children reported in a study by

Moorani et al. were Nephrotic Syndrome (49.3%), CKD (28.7%), urinary stone disease (4%), and obstructive uropathy (3.5%) [5]. There is epidemiological evidence of higher incidence of Nephrotic Syndrome (NS) in children from south Asia [6]. But there is limited information on the epidemiology of CAKUT. By knowing the spectrum of CAKUT and their clinical manifestations, we can address this group of patient early. Early management of congenital disorders can delay the progression CKD as well as prevent CKD. In Bangladesh, data regarding pediatric kidney diseases are scanty due to absence of a national registry. Earlier, a study from a district hospital reports, about 4.4% of hospital admission were due to renal related problems [7]. But study on adult population shows 16-18% patients were CKD and Glomerulonephritis (35%), Diabetes Mellitus (37%) and Hypertension (13%) were the common etiologies [8]. Pediatric nephrology is a new sub specialty in Bangladesh and a few centers are established, among them 4 centers are in Dhaka city, those are referral centers also. Renal replacement therapy is available in the form of peritoneal dialysis and hemodialysis in all 4 centers, but renal transplantation for children is available only in one center (Bangabandhu Sheikh Mujib Medical University). So, an audit of renal diseases in children may provide data that could guide the planners to prevent ESRD. Several studies have so far been done on various aspects of NS, obstructive uropathy, Acute Renal Failure and CKD, but exact pattern of renal diseases in children is yet to be known. Therefore, we have planned to study retrospectively in selected 4 centers of Dhaka city to see the pattern of renal diseases in children.

Materials and Methods

This retrospective observational study was carried out on children and adolescent of 1 day to 18 years of age over a period of 1 (one) year from July'2012 to June'2013.Four pediatric nephrology centers were selected from Dhaka city where renal replacement therapy is available in the form of both hemodialysis and peritoneal dialysis(Bangabandhu Sheikh Mujib Medical University, Dhaka Medical College Hospital, Dhaka Sishu Hospital and National Institute of Kidney Diseases and Urology) and those centers have separate Pediatric Nephrology Outpatient department (OPD) and Inpatient department (IPD).A detailed clinical assessment including history and relevant physical examination was done as initial evaluation followed by Laboratory Investigations. After all the evaluation, diagnosis was made by Resident Physician (RP) at OPD or respective consultant in IPD. Then after taking permission, data regarding individual patient's name, age, sex, presenting features and diagnosis were collected from the registry book kept in IPD and OPD. In all four hospitals, it was found that one patient visited multiple times at OPD and had readmission in IPD during the study period. During multiple visits and admission, diagnosis was being changed from first visit to last like first attack NS became IFRNS, FRNS or others. So, final diagnosis from last visit was taken as diagnosis.

Operational definitions

CKD was defined according to NKF-KDOQI proposed definition, kidney damage lasting for at least 3 months with or without a decrease in GFR or any patient who has a GFR less than 60 ml/min/1.73m^2 for 3 months with or without kidney damage.

Nephrotic Syndrome was characterized by massive proteinuria/ nephrotic range proteinuria (40mg/min/m^2), hypoalbuminemia, hypercholesterolemia and edema. Congenital NS when onset was within the first 6 months of life.

AGN was diagnosed by edema, hematuria (usually gross), oliguria, hypertension along with diminished GFR. Child may present with systemic features also.

AKI was defined according to RIFLE criteria for children, revised by Acute Kidney Injury Network (AKIN), an increase in serum creatinine more than 200-300% or urine output less than 0.5ml/kg/hr for more than 12 hours. UTI was diagnosed when in a symptomatic patient, urine culture was positive with a colony forming unit (CFU) of >105/ml.

Congenital renal anomalies include renal agenesis, renal dysplasia, hypoplasia, renal ectopia and fusion, duplex kidney. They are diagnosed based on ultrasonography (USG), IVP and DTPA renogram.

Neurogenic bladder was defined as dysfunction of the bladder secondary due to spina bifida, cerebral palsy or mental retardation. Vesicoureteral reflux (VUR) was diagnosed by micturating cystourethrogram (MCUG). Renal tubular disorder includes renal tubular acidosis, diabetes insipidus and Bartter syndrome.

Renal stone disease, cystic kidney disease like polycystic kidney disease, multicystic dysplastic kidney and hydronephrosis was diagnosed by USG.

Ethical consideration

Before commencement of the study, ethical clearance was taken from the Institutional Review Board of Bangabandhu Sheikh Mujib Medical University. Then before data collection, permission was taken from the institute head of Dhaka Medical College Hospital, National Institute of Kidney Disease and Urology and Dhaka Shishu Hospital.

Statistical analysis

Data including age, gender, weight and height, clinical findings, laboratory tests and diagnosis was collected on a structured preform and analyzed using Statistical Package for Social Science (SPSS) version 16. The results were expressed as mean and standard deviation (SD) for quantitative variables like age and frequency and percentages were used for qualitative variables like gender, symptoms etc.

Results

During the study period July'2012 to June'2013, about 1123 patients need admission in IPD, among them 722 were male and 401 were female, mean age was 5.84±3.55 years and most common age group was 0-5 yrs (601, 53.5%), followed by 6-10 yrs (372, 33.1%). A total of 5330 patients were visited at the OPD, among them 3336 (62.59%) were male and 1994 (37.4%) were female, mean age was 6.9±1.37 yrs and most common age group was 6-10 yrs 2534, 47.54%) followed by 0-5 yrs (1939, 36.37%).

Table 1shows, pattern of renal diseases in IPD patient. It was found that out of 1123 patient with renal disease, Nephrotic syndrome were 862 (76%), Chronic Kidney Disease 70 (6%), Glomerulonephritis 69(6%) and Acute Kidney Injury 67(5.9%). Other less common renal disorders include obstructive uropathy (1.2%), tubular disorders (0.8%), and cystic kidney diseases (0.18%).

Regarding pattern of renal diseases in admitted patients, Nephrotic Syndrome (n=862, 76%) was the most common disease, followed by CKD (n=70, 6%). Among the patients of Nephrotic Syndrome, about 95% patients were steroid sensitive and 5% steroid resistant. Clinical presentations of children with kidney diseases are shown in table 2. Common presenting features were proteinuria (27.6%), oliguria (26.2%), edema (25.7%), abdominal pain (7.15%) and fever (2.16%).

Table 1. Pattern of renal diseases in Inpatient Department (IPD) (n=1123)

Type of renal disease	Number	%
Nephrotic syndrome	862	76
Chronic Kidney Disease	70	6
Glomerulonephritis	69	6
Acute Kidney Injury	67	5.9
Urinary Tract Infection	25	2
Obstructive Uropathy	14	1.2
Tubular disorder	09	0.8
Polycystic Kidney Disease	02	0.1
Multicystic Dysplastic Kidney	01	0.08
Others	04	0.3
Total	1123	100

Table 2. Presenting features of IPD patients with renal disease (n=1943).

Presenting features	Number	%
Proteinuria	537	27.6
Oliguria/ Anuria	510	26.2
Edema/ Swelling of body	501	25.7
Abdominal pain	139	7.15
Diarrhea/ Vomiting/ Acute gastroenteritis	68	3.4
Fever	42	2.16
Pallor	36	1.8
Respiratory distress	24	1.2
Hematuria	22	1.1
Growth failure	22	1.1
Dysuria/ Urgency/ Frequency/ Straining	12	0.6
Dribbling of urine	10	0.5
Bony change/ Renal osteodystrophy	6	0.3
Headache	6	0.3
Rash (malar/ purpuric)	5	0.25
Pain in limbs	03	0.15
Total	1943	100

Table 2 shows, presenting features of IPD patients with renal disease in this study. Most common presentation of IPD patients were proteinuria (27.6%). Other presenting features were oliguria or anuria (26.2%), edema or swelling of body (25.7%), abdominal pain (7.15%), acute gastroenteritis (3.4%), Fever (2.1%) and others.

Other important presenting features were pallor (1.8%), hematuria (1.1%), growth failure (1.1%) and dysuria (0.6%).

Table 3. Distribution of Chronic Kidney Disease patients in different stages according to etiology (n=70).

Etiology	Total no. of patient	Stage I	Stage II	Stage III	Stage IV	Stage V
Obstructive uropathy	34 (48.5%)	-	01	08	10	15
Glomerulonephritis	24 (34.2%)	-	-	02	04	18
Renal hypoplasia/ dysplasia	08 (11.4%)	-	-	03	-	05
Hereditary/ familial disease	01	-	-	-	01	-
Renal stone disease	01	-	-	01	-	-
Unknown	02	-	-	-	-	02
Total	70	-	01	14 (20%)	15 (21%)	40 (57%)

Table 3 shows, etiology of CKD patients and their distribution in different stages. Common etiologies were obstructive uropathy (48.5%), Glomerulonephritis (34.2%) and renal hypoplasia-dysplasia (11.4%). Most commonly patients present in stage V (57%). There were 61 patients with CAKUT (Fig-1), among them most common diseases were obstructive uropathy (50.82%), renal hypoplasia-dysplasia (8.13%) and cystic renal diseases (4.9%).

Pattern of renal diseases among the OPD patients is shown in table 4. Common diseases were Nephrotic Syndrome (74%), UTI (9.4%) and Glomerulonephritis (5.7%).

Other important diseases were hydronephrosis (3.3%), CKD (2%), obstructive Uropathy (1.8%) and malrotated or ectopic kidney (0.5%).

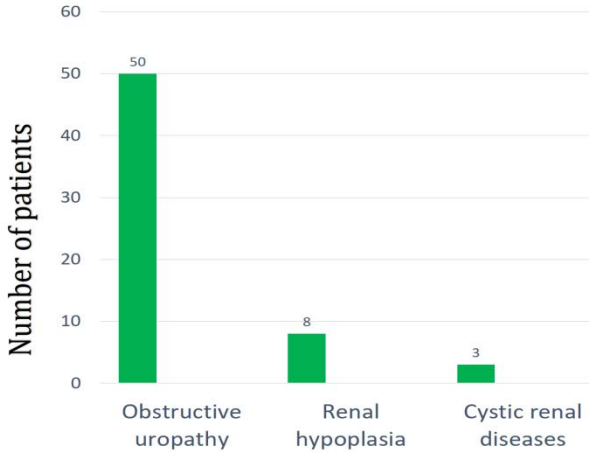

Figure 1. No. of Congenital Anomalies of Kidney and Urinary Tract (CAKUT) patients in IPD (n=61).

Table 4. Spectrum of renal diseases in Out Patient Department (n=5330)

Type of renal disease	Number	%
Nephrotic syndrome	3983	74%
Chronic Kidney Disease	112	2%
Glomerulonephritis	304	5.7%
Acute Kidney Injury	76	1.4%
Urinary Tract Infection	505	9.4%
Obstructive Uropathy	100	1.8%
Tubular disorder	02	
Polycystic Kidney Disease	05	
Hydronephrosis	180	3.3%
Malrotated/ Ectopic kidney	29	0.5%
Single kidney	18	0.33%
Renal stone	12	
Cortical cyst	03	
Undescended testis	01	
Total	5330	100

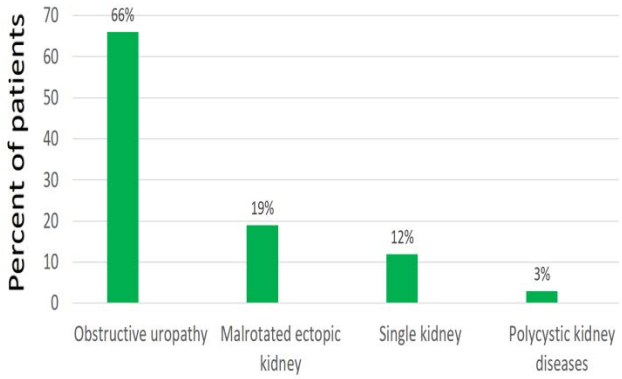

Figure 2. No. of Congenital Anomalies of Kidney and Urinary Tract patient at OPD.

Discussion

This study highlights the epidemiology of renal diseases in children managed at 4 pediatric nephrology centers of Dhaka city. The most common renal disease requiring admission in pediatric nephrology ward was Nephrotic Syndrome (NS) accounting 862 (76%), which was

similar to other studies [5, 9]. Chronic Kidney Disease accounting 70 (6%) and Acute Kidney Injury (AKI) accounting 67 (5.9%) were next two common diseases.

Primary NS has been reported as the most common renal disorder in pediatric population from all over the world [1]. Its frequency varies from 18.5% to 60% in different studies from various geographical regions [1, 5, 9, 10]. In this study Nephrotic Syndrome was found more common in male and male to female ratio was 1.8:1, which corresponds with previous studies [11].

CKD was found as the second most common renal disease in hospital admission (6%) in this study. Similar results were found in the study from Nepal [9]. We found that obstructive uropathy (n=34, 48.5%) and glomerulonephritis (n=24, 34%)were two common etiologies of CKD in this study followed by renal hypoplasia and dysplasia (n=08, 11.4%). Study from neighboring country shows, most common etiologies were renal hypoplasia-dysplasia and urinary stone disease [5]. Data from European countries and North America shows similar results; most common etiologies were CKAUT and obstructive uropathy [12]. Studies from Mid Asian region shows, congenital urological malformations were more common [11, 13]. According to North American Pediatric Renal Trials and Collaborative Study (NAPRTCS, 2014) data, renal aplasia/ hypoplasia/ dysplasia (15.8%) was the most common etiology of CKD followed by obstructive uropathy (15.3%) and Focal segmental Glomerulosclerosis (11.7%) [14]. However, it is consistent with USRD annual data report 2014 [15]. So, studies from different geographical region shows, congenital urological malformations were the main etiology of CKD. Our study shows, similar results also. It was also observed that, most of the patients in this study presented as ESRD (57%), the reason may be all the study centers are tertiary care centers. We found CAKUT in 61(5.4%) patients in this study. CAKUT was about 30% in all the prenatally diagnosed congenital malformations and it is also responsible for more than 50% causes of CKD [5]. In this study we found, CAKUT was the etiology of more than 60% cases of CKD and most common diagnosis was obstructive uropathy (48.5%), then renal hypoplasia-dysplasia (11.4%). But in a study from National Institute of Child Health (NICH), Karachi, Pakistan, they found >85% cases are CAKUT among the etiologies of CKD, where renal hypoplasia-dysplasia was 43% [5]. The reason of these etiological variations in our study may be the CKD cases were presented to hospital in later stage. So, early stages of CKD and CAKUT were remaining undiagnosed in the community.

Glomerulonephritis (6%) was found the third most common disorder in this study. There were 69 cases of Glomerulonephritis, among them, acute post streptococcal Glomerulonephritis was most common followed by Lupus Nephritis [8], Henoch Schonlein Purpura and IgA Nephropathy. Study from NICH shows, similar results but percentages of Glomerulonephritis was higher in the study from Pokhara, Nepal [9]. Other studies from different regions of Africa show similar results [10, 16-18].

The frequency of Acute Kidney Injury (5.9%) was higher than studies from neighboring countries [5, 9]. Urinary tract infection was found 2% in admitted patients but it was 9.4% in OPD patients. It may be due to UTI patients were treated at OPD and complicated UTI patients were only admitted. Nephrotic Syndrome was 74% among OPD patients. There also patients of Hydronephrosis, Malrotated or ectopic kidney, single kidney, renal stone diseases and undescended testis cases visited OPD.

Conclusions

This study identifies the current pattern of renal diseases in children in pediatric nephrology centers of Dhaka city. Nephrotic syndrome is the most common disease, followed by chronic kidney disease and urinary tract infection. Obstructive uropathy is the commonest etiology of CKD. It has been found that, boys were presented more commonly than girls in this study. Most common presenting features were proteinuria, oligouria and edema.

Limitations of the study

- All the four institutes have no individual patient identification number. So patients were identified by their name, age, sex, address and diagnosis.
- At OPD, registry book contains only patient name, age, sex and diagnosis. So, presenting features of OPD patients could not be evaluated.

Recommendations

In light of the findings of the present study and discussions, following recommendations are made.

- Child those who have renal problems detected earlier, should undergo regular follow up throughout the life.
- Treatable congenital problems should have early detection and appropriate management.
- Individual institutes should have a registry book with complete entry of all the findings of the visit as well as a unique identification number to all patients.
- A central nationwide renal database can be prepared for better management of patients.

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