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Original Research Article

Pattern of renal and urinary tract disorders in children

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ABSTRACT

Background: Pediatricians encounter a wide spectrum of renal and urinary tract ailments in children most of which cause considerable morbidity and mortality in children. Such disorders are seen in children of all age groups starting right from infancy up till adolescence. The aim of our study was to study the prevalence, spectrum and clinical profile of such disorders in children.
Methods: This was a hospital based prospective observational study conducted over a period of 12 months from September 2017 to September 2018 at G. B. Pant hospital and Sher-i-Kashmir Institute of Medical Sciences Srinagar. Children presenting with renal and urinary tract disorders between the age group of 1 month and 12 years were prospectively observed and recorded.
Results: Total number of patients between age group 1month to 12 years admitted with renal and urinary tract disorders were 197. Majority of patients i.e. 56 (28.4%) were less than one year old. Mean±SD age of patients was 3.9±3.41 years. Fever was the most common complaint present in 78 patients (39.6%). Urinary tract infection was the most common diagnosis in our study comprising of 71 (36%) patients followed by nephrotic syndrome in 39 (19.8%). Other diagnosis were congenital anomalies of kidney and urinary tract- CAKUT (13.2%), acute glomerulonephritis-AGN (10.2%), Acute kidney injury- AKI (9.1%), chronic kidney disease- CKD in 9 (4.6%) and tubular disorders (4.1%).
Conclusions: Because of their significant prevalence and impact on the quality of life, renal and urinary tract disorders require prompt diagnosis and management because early detection and treatment improves the morbidity and mortality.

Keywords: CAKUT, Haematuria, Nephrotic syndrome, Tubular disorders, Urinary tract infection, Vesicoureteric reflux

INTRODUCTION

Diseases of the kidney and urinary tract constitute a significant proportion of acute and chronic disorders of childhood. Physicians caring for children need to be aware of the common conditions, their prompt recognition and appropriate management.[1]

Infections, inflammation, congenital malformations and progressive impairment of renal function are common conditions found in children. Infants and children may harbour virtually all the urinary tract disorders found in adults, but congenital lesions and their complications predominate in children.[2]

A detailed history has a well-defined role in achieving the correct diagnosis. A record should be made of the results of antenatal imaging studies, particularly the detailed scan performed at around 20 weeks gestation.[2] Antenatal ultrasound is particularly informative with regard to renal

abnormalities, which account for around 20% of all significant fetal abnormalities detected during gestation.[3] Edema can be a major manifestation of renal disease. When associated with Hypoalbuminemia and hyperlipidemia, Nephrotic syndrome is the usual manifestation and when associated with Hypertension, cola coloured urine with azotemia, nephritic syndrome is the manifestation. The presence of a single umbilical artery in an infant is associated with an increased risk of a variety of renal anomalies including vesicoureteric reflux, multiple cystic dysplastic kidneys (MCDK) and renal aplasia and dysplasia.[4] Parental consanguinity is common in a number of communities particularly Muslims.[5] In general, laboratory studies are used to help with diagnosis, prognosis, follow up of approach or effect of therapy. Usually the specific laboratory study performed fits the definition of a biomarker- a characteristic that is measured and evaluated objectively as an indicator of normal biologic processes, pathogenic processes, or pharmacologic responses to a therapeutic intervention.[6] Imaging is essential for diagnosis and management of urinary tract disorders . Ultrasonography provides a rapid assessment of kidney shape and size, and it is especially good at identifying hydronephrosis.[7]

VCUG is the only modality that detects vesicoureteric reflux (VUR) and provides detailed information about the bladder and urethra.[7] Computed tomography (CT) provides excellent anatomic details of the urinary tract and CT has many applications. Radiation exposure is an important risk of CT, and should limit its use to cases where the detail provided outweighs the risk of the study.[8,9] 99mTc-DMSA is the gold standard for the identification of pyelonephritis and renal scars. 99m Tc-DMSA can be utilized to determine renal function and to identify and characterize renal infarcts or anatomically abnormal kidneys such as horseshoe kidneys, pelvic kidneys and crossed fused ectopia.[10,11]

METHODS

Aims and objectives

To find out the: a) spectrum, b) frequency and c) clinical profile of various renal and urinary tract disorders in children in the age group of 1 month to 12 years.

Patients developing AKI during hospitalization with normal renal function on admission were excluded from study.

This was a hospital based prospective observational study conducted over a period of 12 months from September 2017 to September 2018. A total of 197 children admitted in G. B. Pant hospital and Sher-i-Kashmir Institute of Medical Sciences, Soura, Srinagar with renal and urinary tract disease between the age group of 1 month to 12 years were prospectively observed and recorded. A detailed clinical assessment including history and relevant physical examination was done as initial step followed by laboratory tests including complete blood picture, urinalysis, serum creatinine, urea, electrolytes, ABG and ultrasound kidneys, ureters and bladder (USKUB) in all cases. Serum calcium, phosphorus, alkaline phosphatase was carried out in patients with CKD. Serum protein, albumin, cholesterol and spot urine protein to creatinine ratio was done in patients with nephrotic syndrome, primary and secondary GN. Urine culture and sensitivity (CS), micturating cystourethrogram (MCUG) and DMSA/DTPA renal scan were performed in cases of UTI, VUR and PUV. Intravenous pyelography (IVP) was done in children with stone disease or unilateral upper urinary tract obstruction or duplex system, ectopic kidneys. Renal biopsy was done as needed.

Operational definitions

Urinary tract infection was defined as the presence of features of pyelonephritis (fever, flank pain, vomiting), cystitis (dysuria, urgency, frequency, supra-pubic pain) with positive urine culture with a colony forming units (CFU) of >105/ml collected by a standard midstream clean catch specimen, or, a colony count of more than 5 × 104/ml collected by urethral catheterization of a single pathogen.[12]

Chronic kidney disease was defined as kidney damage for 3 months, as defined by structural or functional abnormalities of the kidney, with or without decreased GFR or GFR <60 ml/minute/1.73m^2 for 3 months, with or without kidney damage.[13]

Nephrotic syndrome (NS) was defined as presence of edema, nephrotic range proteinuria (>40 mg/hour per m^2), hypoalbuminemia, hypoproteinaemia and hypercholesterolemia.[14]

Acute kidney injury was defined as any of the following (not graded): increase in serum creatinine by >0.3 mg/dl (>26.5 µmol/l) within 48 hours; or increase in serum creatinine by >1.5 mg/dl times baseline, which is known or presumed to have occurred within the prior 7 days; or urine volume <0.5 ml/kg/hour for 6 hours.[15]

Acute glomerulonephritis (AGN) was diagnosed when there was edema, hypertension, hematuria and red cell casts/granular casts on urinalysis and raised serum creatinine. Secondary GN was defined as presence of hematuria, edema, hypertension and active urinary sediments as seen in systemic lupus erythematosis and Henoch-Shonlein purpura nephritis.[10]

Hemolytic uremic syndrome (HUS) was defined by the traid of microangioipathic hemolytic anemia (MAHA), thrombocytopenia and renal insufficiency.[16]

Urinary stone disease was defined as the presence of stone in the urinary tract i.e. in one or both kidneys or in

either of ureters, urinary bladder and urethra as found on plain x-ray or USKUB.

Renal tubular disorders were labelled if patient had renal tubular acidosis, Bartter/Gittleman syndrome, Fanconi's syndrome or diabetes insipidus.

Vesicoureteral reflux (VUR) was diagnosed by the demonstration of retrograde flow of urine into ureters and kidney on MCUG.[17]

Congenital anomalies of the kidney and urinary tract (CAKUT) which included ureteral duplications, ureteropelvic junction obstruction, horseshoe kidney, ectopic kidneys, posterior urethral valve, obstructive renal dysplasia, and several syndromes associated with renal malformations were diagnosed on ultrasound and other imaging findings.[18]

Statistical analysis

Data including age, gender, weight and height, area of residence (rural/urban), clinical findings and laboratory tests were collected and entered in a Microsoft Excel Spreadsheet. The results were expressed as mean and standard deviation (SD) for quantitative variables and percentages were used for qualitative variables. Categorical variables were graphically summarized as pie charts and bar charts. Graphs were constructed in Microsoft Excel 2010.

Ethical approval was not required for this study.

RESULTS

A total of 16818 patients were admitted during study period. Out of these, 4850 patients were excluded from the study because they were either less than 30 days of age or more than 12 years of age, remaining 11968 patients were enrolled in this study out of which 197 (1.6%) had various renal and urinary tract diseases.

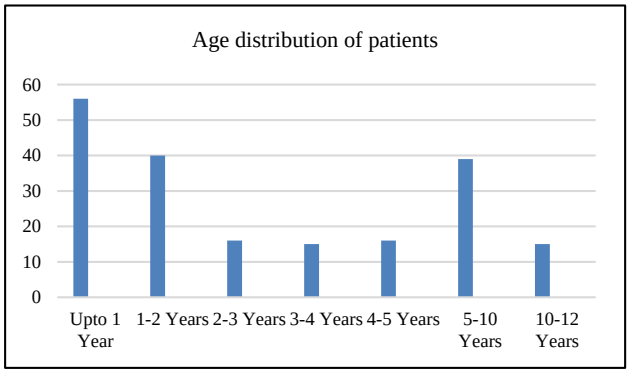

Figure 1: Age distribution of patients.

Majority of patients i.e. 56 (28.4%) were less than one year old, followed by 40 (20.3%) patients 1-2 years of age, 39 (19.8%) aged 5-10 years. There were only 15 (7.6%) patients between 10-12 years of age. Mean±SD age of patients was 3.9±3.41 years.

Out of the 197 patients studied 99 (50.3%) were females and 98 (49.7%) were males with a ratio close to 1:1. 130 patients (66%) belonged to the rural areas and 67 (34%) patients were from urban areas.

Table 1: Presenting symptoms and signs.

Presenting signs/symptoms	Frequency	Percent
Fever	78	39.6
Edema	60	30.5
Anemia (Pallor)	59	29.4
Hypertension	47	23
Vomiting	38	19.3
Hematuria	27	13.7
Abdominal and lion pain	27	13.7
Irritability	23	11.7
Dysuria crying while, micturition	16	8.1
Cola-colored urine	14	7.1
FTT	12	6.1
Oliguria	9	4.6
Febrile seizures	8	4.1
Skin rashes	7	3.6
Polyuria	6	3.0
Joint pain	6	3.0
Polydipsia	4	2.0

Fever was the most common presentation in our study. Other symptoms are tabulated below in Table 1.

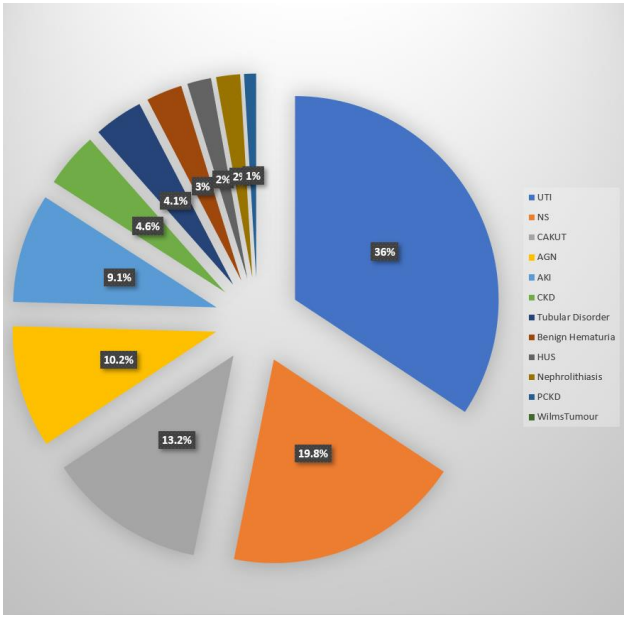

Figure 2: Diagnoses.

Urinary tract infection was the most common diagnosis in our study population comprising of 71 (36%) patients

followed by nephrotic syndrome in 39 (19.8%). Other diagnoses have been shown in Figure 2. Table 2 shows diagnoses as per etiology.

Table 2: Diagnosis as per etiology.

Diagnosis		Frequency	Percent
NS	SSNS	35	17.7
	FSGS	2	1
	DPGN	1	0.5
	MGN	1	0.5
AGN	PSGN	13	6.6
	Lupus nephritis	2	1.0
	HSP nephritis	4	2.0
	IgA nephropathy	1	0.5
CAKUT	VUR	13	6.6
	MCDK	3	1.5
	PUV	2	1.0
	Single Kidney	2	1.0
	Ectopic Kidney	3	1.5
	PUJ obstruction	2	1.0
	Hypoplastic kidneys	1	0.5
Tubular disorder	d-RTA	5	2.5
	p-RTA	1	0.5
	Primary hyperoxaluria	1	0.5
	Barters syndrome	1	0.5
AKI	Dehydration (AGE)	7	3.5
	HUS	4	2
	SEPSIS	4	2
	AGN	3	1.5
HUS	Typical	3	1.5
	Atypical	1	0.5
CKD	Reflex nephropathy	4	2
	Obstructive (PUV)	2	1
	NS	2	1
	CGN	1	0.5

The second most common diagnosis in our study was nephrotic syndrome, present in 39 (19.79%) patients among which 35 (89.74%) were steroid sensitive and 4 (10.25%) were steroid resistant.

In our study population, 20 (10%) patients had AGN, out of which 13 (65%) patients had post streptococcal glomerulonephritis based on hematuria, edema, hypertension, raised ASO titre, decreased C3, throat swab. 2 patients had lupus nephritis in which renal biopsy was carried out in 1 patient which showed focal lupus nephritis stage 3. Renal biopsy was deferred in another patient in view of unstable condition. Both the patients had strongly positive ANA and anti-dsDNA.

Out of 20 patients with AGN, 4 patients were diagnosed with HSP nephritis who had palpable purpura with joint pains, hematuria and proteinuria. The remaining one patient had IgA nephropathy as was documented by renal biopsy.

In our study, 26 patients had congenital anomaly of kidney and urinary tract (CAKUT), majority of which were due to vesicoureteric reflex (13/26) as was demonstrated by micturating cystourethrogram (MCUG) followed by ectopic kidneys (3/26), multicystic dysplastic kidneys (3/26), PUV (3/26), single kidney (2/26) and PUJ obstruction (2/26) (PUJ obstruction was evidenced by DTPA scan).

Among inherited nephropathies, tubular disorders were seen in 8 (4.1%) patients in which distal RTA was seen in 5 (62%) patients, followed by proximal RTA 1 (12.5%), primary hyperoxaluria 1 (12.5%) and Barters syndrome in 1 (12.5%) patient. Two patients who were siblings had polycystic kidney disease with family history of polycystic kidney disease in father.

Acute kidney injury was seen in 18 patients with dehydration being the major cause (7/18) followed by sepsis (4/18), HUS (4/18) and AGN (3/18).

Chronic kidney disease was seen in 9 (4.5%). CAKUT (reflex nephropathy and obstructive uropathy) was the major etiology of CKD in our study group.

Nephrolithiasis was diagnosed in 4 (2%) patients. There was one case (0.5%) of heterogenous left renal mass which was later confirmed by CECT abdomen as Wilm's tumor.

DISCUSSION

The hospital-based prevalence of renal disease from this study was 1.6% which was consistent with studies done by Onifade et al, and Micheal et al wherein the prevalence of renal diseases was 1.1-4.5 each.[19,20]

Fever, in our study as the predominant presentation (39.6%) followed by edema (30.5%) was in conformity with study by El-Tagani et al (2012).[21]

The most common renal disease requiring hospital admissions in our study was UTI in 36% of patients. Similar findings were seen in studies conducted in earlier studies.[20-23]

Nephrotic syndrome was the second most common renal disease in our study group seen in 19.8% patients. Our results were comparable with the studies from Iran by Derakshan et al (18.6%), Libya by AY Elzouki et al (19.2%) and Lagos-Nigeria by Lapado et al (22.8%).[24-26]

AGN was seen in 10.2% patients in our series and was comparable to studies by Lapado et al (10%) and Ezeonwu et al in ASABA (12%).[23,26] This result contrasts sharply from studies conducted by Bhata et al in Nepal (46.5%), Ocheke et al from Jos Nigeria (37.7%), Zhyong

et al in Beijing (30%) and Barrat et al in South Africa (45%).[27-30]

In our study population CKD was found in 9 patients (4.6%) which is comparable to the results of Bhata et al in Nepal (4.2%), Lapado et al (6.2%) and Barrat et al (4%).[26,27,30] In contrast studies from Pakistan by Moorani et al (28.7%), Ocheke et al from Jos Nigeria (20.3%) and Derakshan et al Iran (14.9%) reported a high rate of CKD.[17,24,28] Majority of the patents i.e. 66% with CKD were due to reflex nephropathy and obstructive uropathy (CAKUT), this was in conformity with the studies by Moorani of Pakistan and NAPRTCS.[17,31]

CONCLUSION

The early detection of renal diseases in childhood leads to better outcomes and reduction in the morbidity and mortality. This study was an attempt to find out the burden of renal diseases, their relative occurrence and clinical profile. The difficulty in determining prevalent renal problems relates to under diagnosis, late presentation and non-availability of investigations and/or treatment in the developing countries. The implication of this study is that there is a need for routine screening for renal diseases in children so that children with evidence of kidney disease can be identified early and treated appropriately.

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