Original Research Article

Pattern of pediatric renal diseases in a rural tertiary care hospital

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ABSTRACT

Background: Spectrum of renal disease varies in different population, geographical location, and by environmental factors. The purpose of this study was to find out the occurrence of different pediatric renal diseases at a teaching hospital in the rural part of Maharashtra, India.
Methods: All cases of renal diseases from one month to 12 years of age, admitted to the wards during the period of July 2018 to December 2019, were included in the study. Detailed clinical and laboratory evaluations were performed on all patients. Diseases were categorized as per standard definitions and managed with hospital protocols.
Results: Renal diseases accounted to be 235 cases (2.8%) of total pediatric admissions during study period, of which (61.3%) were male and (38.7%) female. Nephrotic syndrome (NS), was the most common disorder (34%) followed by congenital anomalies of the kidney and the urinary tract (CAKUT) (24.7%), urolithiasis (11%), urinary tract infection (10.63%), chronic kidney disease (CKD) (7.66%) and acute kidney injury (AKI) (3.83%). The causes of AKI were dehydration, urosepsis, septicemia, and acute glomerulonephritis (AGN). Mortality was found in 3.4% of cases and the etiologies were AKI, NS and CKD.
Conclusions: A substantial number of children are hospitalized with renal and urinary tract diseases. NS and congenital defects were the leading renal disorders in this study. These patients need comprehensive services for early identification and management.

Keywords: Children, Nephrotic syndrome, Poststreptococcal glomerulonephritis, Renal disease

INTRODUCTION

In developing countries, childhood renal diseases constitute an important cause of morbidity and mortality.[1] Data from hospital based studies have reported the burden of paediatric kidney diseases ranging from 1.58% to 7.17% in Asian countries.[2-4] Documented diseases include nephrotic syndrome (NS), acute glomerulonephritis (AGN), acute kidney injury (AKI), congenital anomalies of the kidney and the urinary tract (CAKUT), chronic kidney diseases (CKDs) and renal malignancies, with varying rates.[2-10] In India AGN was the most common, whereas in Dubai and Bangladesh, NS ranked the highest.[5-7]

The variations in the patterns of renal diseases amongst the paediatric population are related to differences in genetic predisposition, environmental risk factors for renal diseases, clinical and laboratory capacities to diagnose renal diseases.[2-10]

An interesting feature of pediatric renal diseases is that there is a difference in the occurrence of disease with age and variation in the manifestation of the same disease at different phases of childhood: While tubular disorders predominate during infancy and early childhood, majority of glomerular diseases are generally seen beyond the first few years of life. Hypertension, urinary tract infection, and CKD are notorious to have contrasting clinical manifestations that vary with age.

In children, many signs of kidney disease are either hidden or they mimic other systemic diseases. For example, failure to thrive or growth retardation, recurrent vomiting, and respiratory distress could be the only signs of CKD or a tubular disorder. Bone deformities and neurological manifestations could be indicators of underlying tubular disorders.

A delay in the diagnosis of acute kidney disease and CKDs with the limited resources available for their management often contribute to the poor treatment outcomes seen in the developing countries. It emphasizes the need of identify renal disorders at early stage and monitor them regularly to retard the rapid progression. In the light of this, knowing the pattern of prevailing renal diseases in a particular setting allows for a more focused preventive nephrology that is aimed at reducing the burden of renal diseases in the same locality.

There are very few reports on the prevalence and pattern of childhood renal disorders in rural region of India. Therefore, the aim of this study was to report a one and half year review of the pattern and the outcomes of renal disorders amongst children aged 1 month to 12 years at the teaching hospital located in western Maharashtra, India, between July 2018 and December 2019.

METHODS

Study design

A retrospective analysis of records of children (aged 1 month to 12 years) diagnosed with renal disorders over one and half years (July 2018 to December 2019) at the paediatric nephrology clinic, emergency paediatric unit and paediatric medical ward of the PRH, Loni. The necessary information for the study was extracted from the patients' record files and from the renal register of the paediatric nephrology unit. Children aged <1 month who are routinely seen by the neonatologists were excluded. Patients who did not have records of information required for the study were also excluded. Children re-admitted for the same renal disorder were only counted once at the first presentation.

Ethical approval to conduct the study was obtained from the Institutional Ethics Committee.

Study area

The Pravara rural hospital (PRH) is a hospital attached to medical college in rural part of western Maharashtra. Pediatric department has sub-speciality of pediatric nephrology and intensive care units for newborns and pediatric patients. It serves as a referral centre for other hospitals within the Ahmednagar district.

A study proforma was used to extract information that included demographic characteristics, types of renal diseases, presenting symptoms and signs and outcomes of management of the renal diseases. The outcomes included discharge, discharge against medical advice (DAMA), referred and death.

Definitions of some renal diseases

NS was diagnosed in the presence of oedema, massive proteinuria of urine protein creatinine ratio of ≥ 200 mg/mmol and hypalbuminaemia ≤ 2.5 g/dl (≤ 25 g/l).[11]

AGN was diagnosed in children manifesting with sudden onset of features of glomerular injury, which include haematuria, mild to moderate proteinuria, hypertension, oedema, oliguria and varying degrees of renal insufficiency.[12]

Urinary tract infection (UTI) was defined as an isolation of a bacterium in the urine sample obtained via suprapubic aspiration or at least 50,000 colony forming units (CFU) per ml of uropathogen in urine obtained via catheterisation or the presence of $\geq 100,000$ CFU per ml of uropathogen from midstream urine sample.[13]

AKI was defined as an abrupt decline in renal excretory function characterized by a reversible increase in the blood concentration of creatinine and nitrogenous waste products, often with a decrease in urine output and by the inability of the kidneys to regulate fluid and electrolyte homeostasis in a child.[14]

Serum creatinine estimation measured by Jaffe's method. Estimation of glomerular filtration rate (eGFR) was by the Schwartz's formula, and adequacy of urinary output was based on the body weight.[15]

CAKUTs including, renal dysplasias, pelvi-ureteric junction (PUJ) obstruction and posterior urethral valve (PUV) are diagnosed by ultrasound scan (USS), micturating cystourethrogram (MCUG) and intravenous urography (IVU). PUJ obstruction refers to a dilated renal pelvis with a collapsed proximal ureter caused by abnormal anatomical muscle arrangement, anomalous collagen collar, ischaemic insult, urothelial ureteral fold or extrinsic ureter compression by crossing vessels at the PUJ obstruction, usually diagnosed with USS and IVU.[16]

CKD was based on the national kidney foundation kidney disease outcomes qualitative initiative definition as 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.[17]

Each diagnosis was based on the primary disease. For example, children with UTI and background NS were classified as NS and those with AGN and AKI were classified as AGN. Outcome measures could be: discharge (due to full recovery or significant recovery of renal function); DAMA or loss to follow up; referral to other hospitals; and death.

Statistical analysis

Analysis of the data was performed using statistical package for the social sciences (SPSS) software. The analysis of the data was done by descriptive statistics with percentages and proportions. Comparisons were done by chi-square test and significant p value was considered as <0.05.

RESULTS

Of the 8394 children seen during the study period, 235 had renal disorders giving a prevalence of 2.8% (a prevalence of 28 renal cases per 1000 children seen). The 235 children comprised 144 (61.3%) males and 91 (38.7%) females with a male to female ratio of 1.58:1. The cases were between 1 month and 12 years of age. The mean age was 4.41±3.5 years. Fifty-nine per cent of the children were <5 years of age (Table 1). Renal diseases diagnosed are depicted in Table 2. As shown in Table 2, all diseases occurred more in male than female except CAKUT and AKI where female cases predominate.

Table 1: Age and gender wise distribution of cases.

Age (year)	Male, N (%)	Female, N (%)	Total, N (%)
<1	23 (53.49)	20 (46.51)	43 (18.3)
1-5	65 (68.42)	30 (31.58)	95 (40.4)
5-12	56 (57.73)	41 (42.27)	97 (41.3)
Total	144 (61.28)	91 (38.72)	235 (100)

Age-wise occurrence of common renal disorders has been shown in Table 3. As shown in Table 3, it is seen that nephrotic syndrome is most commonly seen in the age group of four to six years (40%). UTI most commonly occurred in 1-3 years age group (42.3%), urolithiasis was seen more in above 6 years age group (53.8%).

Table 2: Pattern of renal diseases.

Diseases	Male, N (%)	Female, N (%)	Total, N (%)
Nephrotic syndrome	49 (34)	31 (34)	80 (34)
Acute glomerulonephritis	05 (3.47)	02 (2.2)	07 (03)
Urinary tract infection	16 (11.11)	09 (9.9)	25 (10.64)
Acute kidney injury	05 (3.47)	04 (4.4)	09 (3.83)
Chronic kidney disease	12 (8.34)	06 (6.6)	18 (7.66)
Congenital defects	33 (22.92)	25 (27.47)	58 (24.68)
Renal calculi	17 (11.8)	09 (9.9)	26 (11)
Tubular disorders	04	00	04 (1.7)
Tumour	00	03	03 (1.28)
Others	03	02	05 (2.13)

Table 3: Distribution of different renal diseases admitted during this period according to age.

Age (years)	NS	AGN	UTI	AKI	Congenital defects	Renal calculi
<1	00	00	10	02	26	02
1-3	21	00	11	06	18	06
4-6	32	03	03	00	05	04
>6	27	04	02	01	09	14

Table 4: Mixed renal disorder in this study in 32 patients.

Renal disorders	N
UTI and renal anomalies	09
UTI, renal anomalies and CRF (CKD)	04
UTI and NS	10
UTI and renal stones	01
Renal anomalies and CRF (CKD)	08
Total	32

DISCUSSION

The early detection of renal diseases in childhood leads to better therapy and reduction in the morbidity and mortality. This study was an attempt to find out the burden of renal diseases, their relative occurrence, and outcome.

We documented an incidence of 2.8% (28 renal cases per 1000 children seen) for kidney disease among hospital admissions over a period of one and half years. It was comparable with studies in North-East India, Pakistan but lower than that was reported by Sonowal et al in Nepal and by Barman.[3-5,8] The prevalence was higher that reported in Kashmiri children.[2] The reasons for the difference in the prevalence and pattern of renal diseases in this study and those of others could be related to differences in genetic predisposition, environmental risk factors for renal diseases, clinical and laboratory capacities to diagnose renal diseases.[2-10,18-20]

Mean age of presentation in study subjects was 4.37±3.5 years with a gender ratio of 1.58:1 and the most common age group was 1 month to 5 years (58.7%), followed by >5 years (41.3%). Mean age reported by Quder et al was 5.8±3.5 years. Barman et al have reported almost equal number of male and female children being affected.[5]

There was a significant correlation between the pattern of renal disease and the age of presentation; 76% of patients with glomerular diseases were between 4-12 years of age, whereas 76% of those with congenital renal anomalies were below 4 years of age. Similar observations have been reported.[2]

In this study, the major childhood diseases were NS (34%) and CAKUT (24.68%), with urolithiasis (11%) coming at a distant third position. In agreement with our study, Sonowal et al have also reported NS to be the predominant renal disorder.

NS accounted for most multiple admissions in our series (34%). Most of the children required multiple admissions due to severe edema and infection. The mean age of the patient of NS in our study was 5.5 years, which is similar to the findings of previous reports.[21] In the present study, it is observed that nephrotic syndrome is most commonly seen in the age group of four to six years (40%) followed by more than six years (33.75%). That means almost 66.25% of cases of NS presented by six years of age. Srivastava et al reported that 126 children out of 206 Indians <5 years were diagnosed to have NS.[22] It affected more males than females although this was not significant. NS has also been reported to be commoner in male than in female gender by other authors in Asian region.[7] However, no particular explanation has been offered for this male preponderance.

The mean age at diagnosis was 5.5±3.32 years. Majority 77 (96.25%) of them were steroid responsive. Only three cases had steroid resistance. Recently, Ladapo et al had also reported a high steroid sensitivity among children with NS in Lagos.[18]

Other studies have reported UTI as the most common cause of admission.[9,20] While others reported glomerulonephritis as the most common cause of admission due to renal disease.[18,23]

In our study CAKUT comprised 24.7%% cases. Studies from Asian region have reported CAKUT being third common renal disorder.[2,3,8] Severe hydronephrosis was the most common CAKUT in this study and three subjects with PUV also contributed to the cases of CKD seen due to their late presentation. Of these, 16 (27.6%) presented in CKD (with eGFR <60 ml/min/1.73 m^2). Majority of them 26 (44.83%) cases presented early within the first year of life.

Urolithiasis was also common. Similar high proportion has been reported by Ali (15%).[20] They were seen in 17 (11.8%) cases of in male children. It was more in children of age group above six years. The upper urinary tract system was the most common site for stone location. Bilateral renal involvement was seen in more than 17.65% of the cases.

In this study, UTI was suspected in all children below three years presenting with fever. However, we could confirm by urine culture in 25 children. High prevalence of UTI has been reported in a study by Anigilaje et al.[24] UTI occurred more in males (54%) than females (46%). This gender difference was not statistically significant.

Acute kidney injury in our study was caused by hypovolaemia/diarrhoeal disease, NS, sepsis, AGN and severe falciparum malaria. Dehydration, due to gastrointestinal disorders, was the most common cause of AKI in our patients, as has been reported from many other developing countries. In India, NS was also the predominant cause of AKI.[26]

The mean age at presentation of AKI was 3.21±3.57 years. Two children with AKI were referred to another hospital. While CKD was reported in 18 (7.66%) cases, many more might have been lost in peripheral health centres amidst non-recognition or misdiagnosis as observed by Malla et al.[9] In almost all CKD patients CAKUT was the cause. 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%.[8]

The mean age of the subjects with AGN was 7.3±2.69 years, and majority occurred more in male (71.43%) than in female (28.57%) gender. The postinfectious glomerulonephritis (PIGN) remains the common cause of acute glomerulonephritis in children similar to observed in the study by Ali et al.[19]

Tubular disorders were seen in four cases, three of them had renal tubular acidosis (RTA) and a case of nephrocalcinosis. Wilm's tumor was seen in three patients.

In general, regarding the outcome, 91.5% of the patients were discharged with good renal function. The overall mortality of 3.4% in this study. The highest mortality was among patients with AKI (62.5%) followed by those with NS with complications (25%), and CKD (12.5%). Two patients were referred to specialized pediatric nephrology center as our hospital was no equipped with dialysis facility.

Limitations

This study is limited by its retrospective design.

CONCLUSION

NS, CAKUT and urolithiasis were the leading renal disorders in this study. Our study implies that majority of

these ailments are treatable. The difficulty in determining the exact prevalence of pediatric renal disorders relates to under diagnosis, late presentation and non-availability of investigations and/or treatment in rural part of India. 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. It also highlights the need for increased awareness about the renal problems in community. Mortality was high at 3.4%.

ACKNOWLEDGEMENTS

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