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Pattern and outcome of renal diseases in hospitalized children in Khartoum State, Sudan*

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ABSTRACT

In developing countries, renal diseases in children constitute important causes of morbidity and mortality. In Sudan, data about patterns and outcome of these disorders is generally scanty. We conducted this study to provide basic renal data that may be utilized by researchers and health planners in a resource poor setting. A retrospective record review of all pediatric patients, followed in four teaching hospitals in Khartoum State over a five- year period (January 2000- June 2004), was achieved.

In 150 hospitalized children a total of 200 renal diagnoses were recorded. Urinary tract infection (UTI), occurring with other underlying renal morbidities or isolated, was the commonest renal diagnosis (20%). The second common renal disorders were nephrotic syndrome (NS) and urolithiasis/stones accounting for 16% and 15.5% of cases, respectively. Acute glomerulonephritis (AGN) and congenital anomalies were relatively less common (12% and 10.5%, respectively). Other less frequently detected diseases were acute renal failure (ARF) in 6%, chronic renal failure (CRF) in 4%,

hereditary nephropathies in 3.5% and renal tumors in 2.5%. There was a significant correlation between the pattern of renal diseases and age of patients ($P=0.001$) but not their gender or social class ($P=0.211$ and 0.34 , respectively). On follow up, 99 out of 150 patients (66%) recovered their normal renal function, 6/150 (4%) remained with persistent proteinuria, 30/150 (20%) progressed to CRF, 10/150 (6.7%) died, and 5/150 (3.3%) were referred to radiotherapy department for further management. Our data reflects geographical variations of patterns of renal diseases in Sudanese children as in other countries. Many of these diseases are preventable or potentially curable. Therefore, improvement of pediatric renal services and training of health workers would help in early detection and treatment of these conditions leading to reduction in their morbidity and mortality.

Key words:

Sudanese children; Renal diseases; Urinary tract infection; Nephrotic syndrome; Urolithiasis; Glomerulonephritis; Renal anomalies; Renal failure.

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INTRODUCTION

Studies from different geographical areas around the world have reported variable patterns of renal diseases in pediatric population [1-5]. These variations could be related to genetic predisposition, environmental factors, or lack of awareness about importance of early diagnosis of such disorders. Children with potentially treatable conditions, e.g urological, are often referred late with advanced disease. Lack of advanced diagnostic and treatment facilities in many of our hospitals often leads to inaccurate diagnosis and suboptimal treatment. These factors eventually lead to progression of renal disorders to end stage renal failure (ESRF) resulting in high morbidity and mortality [6,7]. Data about pediatric renal diseases in Sudan are generally scanty. Development of pediatric renal services in our hospital in 2005 has improved our data registry. We retrospectively report the pattern and outcome of renal diseases among hospitalized Sudanese children in Khartoum State with the aim of providing basic information about these diseases. Such data could then be utilized by researchers and health planners in a resource poor setting.

MATERIAL AND METHODS

We reviewed the records of all patients with a diagnosis of renal disease who were admitted to four teaching hospitals in Khartoum State; (1) Soba University hospital, (2) Gaafar Ibn Oaf Children's Hospital, (3) Ahmed Gasim Children Hospital, and (4) Omdurman Children Hospital. Study period was from January 2000 to June 2004. During this period pediatric renal services were mainly provided at Soba University Hospital from which most of these data were collected. In the other hospitals children were managed by general pediatricians and adult nephrologists. Children were referred only when further workup and treatment (e.g biopsy, surgery or dialysis) were required. Data were carefully reviewed and all

patients with incomplete records were excluded. The data included personal, clinical and laboratory data. Data about age, gender, race, clinical signs (edema, hypertension), urine tests (cultures, urine microscopy, dipstick for protein, protein quantitative tests), blood tests (urea, creatinine, albumin, electrolytes, ASO titre), histology for renal biopsy, and imaging (ultrasound scan [USS], micturating cystourethrogrm [MCUG], dimercapto-succinic acid [DMSA] scan) were carefully recorded. Outcome measures were recovery of normal renal function, persistence of proteinuria, chronic renal failure (CRF), or death.

Statistical analysis

Data entry and analysis were done using a software program statistical package for social science (SPSS) version 18. Descriptive statistics used comprised mean, standard deviation (SD) \pm and percentages. The comparative statistics were chi-square test and Students t-test. Statistical significance was defined as $P < 0.05$.

RESULTS

A total of 150 children (105 males; 70%) with the diagnosis of renal disease were enrolled in the study giving a male to female ratio of 2.3:1. The mean age at the time of diagnosis was 6 ± 2.1 years (range 1 month-18 years). Forty per cent of the patients were below 5 year of age, 38.7% between 5-10 years, and 24.4% above 10 years of age. The majority of patients (83%) were from low socio-economic class. The most common presenting features of renal diseases were edema and proteinuria (Table 1).

Out of 150 studied children, a total of 200 diagnoses of renal diseases were detected (Table 2). There was a significant correlation between the pattern of renal disease and the age of presentation ($P = 0.001$); 82% of patients with glomerular diseases were between 5-10 years of age whereas 92% of those with congenital

Table 1- Presenting features of childhood renal diseases in Khartoum State, Sudan

Presenting feature	Frequency	Percentage
Oedema (generalized or facial) + proteinuria	60	40.0
Non-specific symptoms(vomiting, fever, convulsions)	56	37.3
Urinary symptoms (burning micturition, poor urinary stream, frequency, drippings)	37	24.6
Haematuria	36	24.0
Oliguria	9	06.0
Loin and/or suprapubic pain	8	05.3

Table 2- Types of renal diagnoses (n=200) in 150 children with renal diseases in Khartoum State

Renal diagnosis	Frequency	Percentage
Urinary tract infection	60	30.0
Nephrotic syndrome	32	16.0
Urolithiasis/stones	31	15.5
Acute glomerulonephritis	24	12.0
Congenital renal anomalies	21	10.5
Congenital obstructive uropathy (PUV;10 & Neurogenic bladder; 3)	13	
Hpoplasia/dysplasia	4	
VUR	3	
Nephrocalcinosis	1	
Acute renal failure	12	6.0
Chronic renal failure	8	4.0
Hereditary nephropathy	7	3.5
Renal tubular disorders	3	
PCKD	2	
Congenital NS	2	
Renal tumors	5	2.5
Total	200	100.0

NS - nephrotic syndrome, PCKD - polycystic kidney disease, PUV - posterior urethral valve, VUR - vesicoureteric reflux

renal anomalies were below 5 years of age. However, there was no significant correlation between the pattern of diseases and gender ($P = 0.211$) or social class ($P = 0.34$).

Urinary tract infection (UTI) was the commonest renal diagnosis in the study group, accounting for 30% (60/200 cases, Table 2). The majority of UTI cases (86.7%) were detected in association with other underlying renal diseases (40% of urolithiasis;

21.4% of nephritic syndrome, 14.2% of congenital anomalies, and 11.1% of acute glomerulonephritis).

Nephritic syndrome (NS) and urolithiasis/stones were the second common renal conditions accounting for 16% and 15.5% of cases, respectively. Site of renal calculi in patients with urolithiasis were; one or both kidneys and/or ureters in 21 cases (67.7%) and bladder in 10 (32.3%). In patients with NS, steroid sensitive NS (SSNS) was diagnosed in 21

cases (65.6%) and steroid resistant NS (SRNS) in 11 (34.5%). Histopathology in SRNS patients was focal segmental glomerulosclerosis (FSGS) in 7 (63.6%) and membranoproliferative glomerulonephritis (MPGN) in 4 (36.4%). There was no significant correlation between steroid responsiveness and age or haematuria at presentation ($P = 0.151$ and 0.573 , respectively). However, hypertension was significantly more common in SRNS than SSNS ($P < 0.005$).

Acute glomerulonephritis (AGN) and congenital renal anomalies were relatively less common (12% and 10.5%, respectively). Twenty one out of 24 cases with AGN (87.5%) had clinical and biochemical features of acute post-streptococcal glomerulonephritis (PSGN) including haematuria \pm oedema \pm hypertension \pm oliguria and \pm significant ASO titre. The biopsy findings in the remaining 3 cases of AGN were crescentic GN in 2 and MPGN in one. Urinary tract anomalies were diagnosed in 21 patients, most of them (13/21) were due to obstructive uropathy. Posterior urethral valve (PUV) was the commonest cause of renal tract anomalies (10/13).

Acute renal failure (ARF) and chronic renal failure (CRF) were among the least common renal diagnoses (6% and 4%, respectively). ARF resulted

from various causes; severe fluid losses from acute gastro-enteritis accounted for 50% of cases, mainly in infants and young children. Sepsis accounted for 33.3%, mainly in neonates. Severe malaria, AGN, and calculus anuria were the causes of ARF in the remaining 16.7% of cases. Hereditary nephropathies and renal tumors were detected in only 3.5% and 2.5% of patients, respectively. Causes of hereditary nephropathies were variable. All renal tumors were nephroblastoms.

By the end of the study; 99 out of 150 patients (66%) recovered normal function, 6 (4%) remained with proteinuria, 30(20%) progressed to CRF, 10(6.7%) died, and 5(3.3%) were referred to radiotherapy department (Table 3).

DISCUSSION

This study defines for the first time the pattern and outcomes of childhood renal diseases in Sudan based on hospitalized children followed in four teaching hospitals. Most of the patients were followed in our unit in Soba University Hospital where pediatric renal services were developing. By then, a pediatric unit in our hospital had been developing rather

Table 3- Outcome of childhood renal disorders in Khartoum State

Renal disease	Recovery	Persistent proteinuria	CRF	Death	Referred to radiotherapy	Total
NS	20 (62.5%)	6 (21.8%)	5 (15.6%)	1 (3.1%)		32(100%)
Urolithiasis	21 (65.6%)	0	10 (32.3%)	0		31(100%)
AGN	21(87.5%)	0	1 (4.2%)	2 (8.3%)		24(100%)
CRF	0	0	8 (80%)	2 (20%)		10 (100%)
ARF	10 (83.3%)	0	0	2 (16.7%)		12(100%)
Congenital anomalies	14 (66.6%)	0	6 (28.7%)	1 (4.7%)		21(100%)
Isolated UTI	8 (100%)	0	0	0		8 (100%)
Hereditary nephropathies	5 (71.4%)	0	0	2 (28.6%)		7 (100%)
Renal tumors	0	0	0		5 (100%)	5 (100%)
Total	99 (66%)	6 (4%)	30 (20%)	10 (6.7%)	5 (3.3%)	150 (100%)

AGN - acute glomerulonephritis, ARN - acute renal failure, CRF - chronic renal failure, NS - nephrotic syndrome, UTI – urinary tract infection

comprehensive treatment facilities, including renal biopsy and peritoneal dialysis (acute and intermittent). Cooperation with colleagues in adults' units helped in offering haemodialysis and renal transplantation for a limited number of patients. The pattern and outcome of renal diseases in Sudanese children is difficult to determine precisely, because of the current pattern of referral and lack of a national data registry. The most common renal disease requiring hospital admissions in this series was UTI (30%). This finding is similar to published reports from Nigeria (32.5%) and Venezuela (32%) [3, 8]. However, other studies from African and Asian countries had reported higher prevalence rates (62% and 68.9%, respectively) [9, 10]. In contrast, lower rates had been reported from other areas in these continents (3.5% and 11.6%, respectively) [1, 11]. This variation could be related to variation in prevalence rates of other underlying renal morbidities. In our series most of UTI cases (87%) were diagnosed in association with other renal morbidities (urolithiasis/ stones, NS, congenital anomalies and AGN). These morbidities were detected in more than 50% of our patients, which may explain our findings. Similarly other workers have also reported occurrence of UTI in association with these renal disorders [3,8,12]. Urolithiasis and NS were the second common causes of renal diseases in our children (15.5% and 15%, respectively). This relatively high incidence of renal stones in this study contrasts with reports from some African and Latin American countries in which these disorders were described as rare or having low incidence [8,9]. Our results are comparable to reports from Saudi Arabia in which these disorders were found to be relatively common [13,14]. This high incidence of stones in our series and these studies may be related to the hot weather as well as nutritional or genetic factors. About a third of our patients with urolithiasis had bladder stones which could be related to the prevailing poor nutritional conditions. In many other studies NS was found to be the second

common pediatric renal disease occurring with variable frequencies [1,3,9,10,15]. We diagnosed NS in 15% of our patients. This finding is comparable to that reported from Nigeria (14.6%) and Iran (18.6%) [9,15]. In contrast, higher figures had been reported from different parts of the world; Nepal (34.1%), Nigeria, Calabar (30.7%), China (28%), and Jordan (22.3%) [1,16-18]. This variation in prevalence rates may be related to pattern of referral, genetic and/ or environmental factors. In this series about one third of our nephrotic children had SRNS; FSGS was the commonest type. The incidence of SRNS tends to be high in Black populations and FSGS is the most common histological type [19, 20]. Our finding in this respect is comparable with other studies from African countries [19,20].

In the present series AGN, commonly post-streptococcal glomerulonephritis (PSGN), was a relatively less frequent diagnosis (12%). This result contrasts sharply with reports from different countries showing higher prevalence rates of AGN; Nepal (46.5%), Jos, Nigeria (37.7%), China (30%), and South Africa (45%) [1,11,17,21]. Environmental, racial, and genetic factors may have a role. Uncontrolled use of antibiotics leading to a low streptococcal infection rate may be additional factor in our community. Moreover, our patients with PSGN are often managed at secondary care level and only symptomatic or severe cases are referred to a tertiary level.

In this study, renal tract anomalies disorders were relatively uncommon (10.5%) with PUV being the commonest anomaly. Our results are comparable to other studies from Nepal (7.3%) and Iran (7.3%) [1,15] but less than that reported from Venezuela (25%) and Jordan (28.4%) [9,18]. These variations could be related to genetic factors or availability of facilities for early diagnosis of these disorders. Lack of screening programs for antenatal diagnosis, advanced diagnostic facilities, and of awareness among secondary care specialists about importance

of early detection of these diseases may explain our relatively low figures.

ARF was diagnosed in 6% of patients in the present study. Our results are comparable to other studies from developing countries [1,3,15,21]. Fluid losses accounted for about 2 thirds of our patients with ARF. In contrast, in other studies haemolytic uraemic syndrome (HUS) and AGN were among the commonest causes [1].

At presentation only 8 children (4%) had CRF which is comparable to other studies from Nepal (4.2%) and South Africa (4%) [1,21]. In contrast, higher figures were reported from other developing countries; Jos, Nigeria (20.3%), Iran (14.9%), and Jordan (17.3%)[11,15,18]. Lower rates were reported from Venezuela (1.6%) and other Nigerian studies (2.1%) [8, 9]. However, on short term follow up 30 of our children (15%) developed CRF bringing our CRF rates closer to that of other developing countries; Jos, Nigeria (20.3%), Iran (14.9%) and Jordan (17.3%) [11,15,18]. This high prevalence may be due to the late presentation of our patients, lack of early diagnosis and inadequate management. Causes of CRF in our series were variable. Urolithiasis/stones was the commonest cause (10/30 cases) followed by chronic GN (7/30) and renal anomalies (7/30). Our result is different from previous reports [22] and other studies from developing countries [23-26] showing predominance of chronic glomerulonephritis as a cause of CRF. In contrast, in Western and many Arab countries urologic malformations were the main causes of CRF [27, 28]. However, renal stones as an important cause of CRF had been shown in a previous report [22] and studies from Arab countries; Syria [29], and Kuwait [30] accounting for 9.3%, 18%, and 10.4% of cases of CRF, respectively. The hot weather, high rate of consanguinity, or other as yet unknown factors might have a role in this respect.

Heredofamilial renal disorders and renal tumors were rare diseases in our study (3.5% and 2.5%,

respectively). Regarding heredofamilial disorders, our results contrast sharply with that described from some Arab countries in which these disorders were described as frequent causes of renal morbidities [4,7]. This could be related to the higher rate of consanguinity in these communities. However, the relatively high rate of consanguinity in our community would not be in favor of this explanation. Therefore, lack of advanced tests required for the diagnosis of these conditions might have lead to their low incidence. Renal malignancies were diagnosed in only 5 patients in this study and all were nephroblastomas. Similar observation had been reported from other African countries [9,11].

On follow up, 10 patients (6.7%) died from various causes such as ARF, CRF, and congenital NS. Lack of adequate dialysis facilities, nutritional support, and poor socioeconomic status were among factors contributing to mortality. It is difficult to compare our mortality rate with others since almost all similar studies had not commented on mortality rates. However, one study from China [17] reported a very low rate of 0.4%.

Our study was not without limitations. This was a retrospective study in which accuracy of data collection can be doubted. Another limitation is that many diseases, e.g heredofamilial, might have been missed because of lack of diagnostic facilities. Therefore, true incidence of these diseases might be underestimated. Nevertheless, the study provides information about this important health problem.

In conclusion, our data reflect the geographical variations in the patterns of renal diseases which may be due to current pattern of referral. This study showed that UTI is the most common renal disorder in Sudanese children in Khartoum State. UTI in our children commonly occurred with other underlying renal morbidities which is consistent with other studies. However, our results are different in revealing an exceptionally high incidence of renal stones which

needs further investigations. Late presentation might be an important cause of high incidence of CRF and mortality rate in our patients. Most of these renal morbidities and mortalities can be prevented with early diagnosis and referral. This can be achieved by improving pediatric health services and strengthening training programs of health workers at primary and secondary levels. The ongoing development in pediatric renal services in our hospital would be of great help in this respect.

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