

**Original Article**

**Chronic Renal Failure in Children in the Western Area of Saudi Arabia**

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**ABSTRACT.** Sixty-six children (35 boys and 31 girls) aged 14 years or younger, with chronic renal failure (CRF), were reviewed in the department of pediatrics at The King Abdul Aziz University Hospital (KAUH), Jeddah, over a four-year period from September 2000 until July 2004. Fifty-nine percent (39 patients) were Saudi Nationals while the remaining were from other nationalities. Forty-two percent lived outside Jeddah in other cities of the western or the southern provinces. Their mean glomerular filtration rate (GFR) was  $15.3 \pm 11.1$  ml/minute/1.73m<sup>2</sup>; 50 patients (76%) had severe CRF with GFR of  $< 25$  ml/minute/1.73m<sup>2</sup> of whom 34 (52%) were in end-stage renal failure (ESRF), with GFR  $\leq 10$  ml/minute/1.73m<sup>2</sup>. The mean age at first presentation was  $4.5 \pm 4.3$  years, while the mean age at referral to a pediatric nephrologist was  $6.6 \pm 4.4$  years. Congenital abnormalities of the renal system were the major cause of CRF (33 patients, 50%) followed by neurogenic bladder (19.6%), either idiopathic (6%) or associated with neural tube defects (13.6%). Hereditary conditions were the cause in 12% and glomerular disease in 13.6%. Fourteen children (21.2%) received peritoneal dialysis, seven (10.6%) received hemodialysis, two (3%) were transplanted abroad and 12 patients (18%) died. Our study, which is the first from Jeddah on the epidemiology of CRF in children, shows that the profile is similar to other parts of the KSA with a predominance of congenital causes. There was a considerable delay in referring children with CRF patients to a pediatric nephrologist resulting in delay in the management of preventable causes such as neurogenic bladder associated with neural tube defects.

**Key words:** Chronic renal failure, Children, Epidemiology, Saudi Arabia.

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**Introduction**

Pediatric nephrology is an established subspecialty in the western countries where renal replacement therapy (RRT) for children with end-stage renal failure (ESRF) has been used for several decades.<sup>1</sup> However, it is still

a growing subspecialty in developing countries. In the Kingdom of Saudi Arabia (KSA), the first peritoneal dialysis (PD) in a child was performed in June 1982 at the King Saud University in Riyadh.<sup>2</sup> Since then, rapid expansion has occurred in the facilities for delivering dialysis in the Kingdom.<sup>3-4</sup> However, pediatric dialysis has remained as part of adult services except in a few centers in Riyadh. In Jeddah, which is the largest city in the western province, RRT for children is provided in a few hospitals as part of the adult units; however, pediatric nephrologists often supervise the care of children.

Since September 2000, we have established the pediatric nephrology division at the King Abdul Aziz University Hospital (KAUH) with facilities for pediatric PD and hemodialysis (HD). KAUH is a referral center in the western area of KSA and accepts both Saudi and non-Saudi patients.

There are few reports from the central and Asir regions of the Kingdom describing the epidemiology of chronic renal failure (CRF) in Saudi children.<sup>5-8</sup> To the best of our knowledge, no similar reports have been published from the western region of the KSA.

The aim of this study is to provide epidemiological data about CRF in children in the western province of Saudi Arabia. This region is different from other parts of the Kingdom because of the heterogeneous nature of the population caused by the proximity to the holy cities. In this study, we highlight the difficulties facing pediatric nephrologists in providing good care for children with CRF, in the presence of numerous social and financial obstacles.

### **Patients and Methods**

Until August 2000, general pediatricians looked after pediatric nephrology cases at

the KAUH. Since then, a pediatric nephrology team comprising two pediatric nephrologists and two pediatric dialysis nurses look after children with CRF. The team also includes a part-time dietitian and a part-time social worker. The unit policy is to provide free care for all patients. A major part of the cost of treatment is provided by the university and by charity agencies; however families have to purchase some of the medications.

All CRF children with glomerular filtration rate (GFR) less than 50 ml/minute/1.73m<sup>2</sup>, who were seen after August 2000, were enrolled in the study. The GFR was measured using diethylene triamine pentacetic acid (DTPA) scan or calculated using Schwartz formula. Patients' notes were reviewed for their age at presentation for the first time, age at referral to pediatric nephrologists, gender, diagnosis and medical and social history. Results were expressed as mean  $\pm$  standard deviation (SD) or median (range).

### **Results**

A total of 66 children with CRF (35 boys and 31 girls; male to female ratio 1.3:1) were reviewed over a four-year period. Their mean GFR was  $15.3 \pm 11.1$  and median (range) was 10 (5-49) ml/minute/1.73m<sup>2</sup>. Fifty patients (76%) had severe CRF with a GFR of  $< 25$  ml/minute/1.73m<sup>2</sup> of whom 34 patients (52%) were in ESRF with GFR  $\leq 10$  ml/minute/1.73m<sup>2</sup>. Thirty-nine children (59%) were Saudi, 15 non-Saudi Arabs (11 Yemeni and 4 Palestinians), seven Asians (3 Bengali, 2 Pakistani and 2 Afghanistani), four Africans (2 Eritrean, 1 Somali and 1 Sudanese) and there was one Filipino.

The etiology of CRF was mainly congenital abnormalities of the renal system (50%): 18 patients had renal dysplasia, either isolated or in association with posterior

Table 1. Causes of chronic renal failure in children in our study patients (n=66).

Diagnosis	Number of patients	Percentage
<b>Urinary system anomalies</b>	<b>33</b>	<b>50%</b>
Posterior Urethral Valve	11	17%
Vesicoureteric Reflux	11	17%
Renal Dysplasia	8	12%
Other anomalies	3	4.5%
<b>Hereditary conditions:</b>	<b>8</b>	<b>12%</b>
Congenital nephrotics	3	4.5%
ARPKD	2	3%
FHHNC	2	3%
Cystinosis	1	1.5%
<b>Neurogenic bladder</b>	<b>13</b>	<b>19.6%</b>
Spina bifida or sacral agenesis	9	13.6%
Idiopathic	4	6%
<b>Glomerular</b>	<b>9</b>	<b>13.6%</b>
Steroid resistant nephrotic syndrome	5	7.5%
Rapidly progressive glomerulonephritis	4	6%
Cortical necrosis	1	1.5%

ARPKD= Autosomal recessive polycystic kidney disease

FHHNC= Familial hypomagnesemia hypercalciuria nephrocalcinosis syndrome

urethral valve (PUV), 11 had primary high grade (IV and V) vesico-uretral reflux (VUR, 2 with single kidney) and one each had recto-cloacal anomaly, the prune belly syndrome with persistent urachus, and bladder exstrophy. When we looked at the sex difference in this group, there was more male predominance with male: female ratio of 2:1.

Twelve percent had inherited diseases: three had congenital nephrotic syndrome (one of them had the Drash syndrome), two had autosomal recessive polycystic kidneys (ARPKD), one had cystinosis and two others had familial hypomagnesemia hypercalciuria nephrocalcinosis syndrome (FH HNC).<sup>9</sup> Thirteen children had neurogenic bladder (8 associated with spina bifida and one with sacral agenesis).

Ten children had acquired causes of CRF: five had steroid resistant nephrotic syndrome including three patients with focal and segmental glomerulosclerosis, four had rapidly progressive

glomerulonephritis (RPGN) and one had cortical necrosis following cardiomyopathy caused by using adriamycin for neuroblastoma. In three children, the cause of CRF was unknown. Table 1 summarizes the causes of CRF in our cohort. Patients with FHHNC had affected siblings with impaired kidney function, but they were excluded from the study as their GFR was above 50 ml/minute/1.73m<sup>2</sup>.

Associated problems encountered included the following: six children had global developmental delay (2 microcephalics); four had cardiovascular lesions (2 congenital heart diseases and 2 cardiomyopathy); three had various syndromes (Down's, Rubinstein-Taybi, Biedl-Bardet in one child each); two had multiple anomalies and one child had congenital glaucoma and thrombocytopenia with infantile nephrotic syndrome.<sup>10</sup> Seven of the spina bifida patients were paraplegic, bound to a wheelchair and totally dependant

Table 2. Age distribution of CRF children when they presented initially and at referral to pediatric nephrologists

Age (years)	Number of patients at initial presentation	Number of patients at referral to a pediatric nephrologist
< 5	40 (61%)	25 (39 %)
5-9	14 (21%)	20 (30 %)
10-14	12 (18 %)	21 (31%)

on others for their daily needs.

The mean age of the study patients at first presentation was  $4.5 \pm 4.3$  years (median 2.5 range 0-14), while the mean age at referral to a pediatric nephrologist was  $6.6 \pm 4.4$  years (median 7, range 0.1-14). Thirty-nine percent of the patients were younger than five years at initial presentation and 61%, at referral to the pediatric nephrologist (Table 2). Thirty-five children were seen initially by a pediatrician, 17 by a urologist, six by a surgeon, five by an adult nephrologist and one by an orthopedic surgeon.

Of the 66 children, 14 (21.2%) received PD (10 continuous ambulatory peritoneal dialysis [CAPD] and four automated peritoneal dialysis [APD]) for a mean duration of  $9.5 \pm 8.6$  months. Seven children (10.6%) received HD for a mean duration of  $4.4 \pm 3.0$  months. The families of three children refused dialysis and thought that their children will suffer more if they were dialyzed.

Two children (3%) had renal transplantation abroad and two others were referred to a local transplantation center to receive kidney from live related donors.

Twenty-eight children (42.4%) lived outside Jeddah (8 Makkah, 9 Taif and the remaining from longer distances like Al-Madina 2, Qunfadah 2, Khulies 2, Tabook, Tarabal and Gizan, 1 each). Thirty-one children (47%) belonged to families with difficult socio-economic conditions (income less than 2000 Saudi Riyals per month).

Ten children died (15%): two on CAPD

(1 chicken-pox pneumonitis and 1 sepsis), one on APD (sepsis), one on HD and five on conservative management (3 sepsis, and intracranial bleeding and severe heart failure as a result of cardiomyopathy in one each). Two of those who died were developmentally delayed and one of the CAPD patients was paraplegic due to spina bifida.

Four dialysis patients (two CAPD and two HD) were transferred to other units; (two outside Jeddah because of the distance and other two to adult units in Jeddah because of the age of the patients. Unfortunately, two of those children (one HD and one PD) died a few months after referral. Both of them presented to the new hospitals' emergency rooms with fluid overload and pulmonary edema. Accordingly, the overall mortality in our study group was 18% (by including those two patients).

Seven children did not attend follow-up in the clinic after discharge from the hospital and many of the families were non-compliant to the prescribed medications. When parents of the affected children were approached for kidney donation, the main worry expressed was that they might not be well enough to look after their other children if they donated their kidneys. The parents, particularly non-Saudi, also expressed concern about the success of the transplant operation and the difficulty to get access to a good transplant center.

## Discussion

This is the first study from the western region of Saudi Arabia describing the epidemiology of CRF in children. We saw 66 children over a four-year period, which coming from one center is rather high. The reported prevalence of CRF in children up to the 18 years of age in KSA is 20.4 per million age adjusted age population (pmp)<sup>6</sup> which is lower than the figures from western countries such as the United Kingdom (UK)<sup>11</sup> and Sweden.<sup>12</sup> However, the reported incidence is higher<sup>5,13</sup> than those reported in some other western countries.<sup>11-12</sup> According to the SCOT data, the annual incidence of ESRF in Saudi children up to 20 years of age is 14 pmp.<sup>13</sup> A study from the southwestern part of KSA reported the incidence for CRF of 15.6 pmp and for ESRF of 9.2 pmp /year for children aged under 12 years.<sup>5</sup> This discrepancy between the prevalence and the incidence could be explained by the high mortality rate in CRF children as was observed in our study (18% over 4 years). The high mortality rate could be explained by delayed referral probably caused by undefined referral system, limited facilities and poor communication between different hospitals. Although, a 18% mortality over four years is high when compared to data from western countries, it is low when compared with studies from other developing countries such as Nigeria where a mortality rate of 58.3% over five years was reported in CRF children.<sup>14</sup> Our study indicates that there was considerable delay (>2 years) between initial presentation and referral to a pediatric nephrologist. Furthermore, there was poor compliance to the treatment in addition to the poor socio-economic conditions in the majority of our cohort.

Similar to other national<sup>5-8</sup> and international studies,<sup>11-12,14</sup> congenital abnormalities

of the renal system were the predominant causes of CRF and they occurred more frequently in boys. Hereditary causes contributed to 12% of the cases which is not considerably different from other local studies (9.3%-18%), the North American Pediatric Renal Transplant Study (NAPRTCS: 13.3%) or studies from the UK (17.6%).<sup>5-7,10-13,15</sup> In contrast, hereditary diseases were the cause in 35% of ESRF children and 26.3% of CRF cases in Sweden.<sup>11</sup> Glomerular lesions were the cause of CRF in 13.6% which is similar to data from most of the previous national (14, 17.7%)<sup>5,7</sup> and international studies from the UK and Sweden (10.3-14.4%). However, others have reported either higher<sup>6,14</sup> or lower percentage of glomerular diseases as a cause of CRF in children.<sup>8</sup> We had a considerable proportion of CRF, caused by neurogenic bladder associated with spina bifida. This could be explained by the delay of appropriate treatment with clean intermittent catheterization and anti-cholinergic drugs such as oxybutynin. Furthermore, poor compliance and financial difficulties could play a role in this high prevalence.

High rate of consanguineous marriages as well as large families in the KSA, possibly explain the presence of unusual associations representing new syndromes and it may also explain the presence of more than one member in the family affected with hereditary renal diseases.<sup>9-10</sup>

RRT was possible in the form of HD and PD; however, only two children were transplanted, outside the Kingdom. This demonstrates the difficulties facing pediatric nephrologists in the absence of an organized referral system to transplantation centers. In addition, there was great reluctance from the parents to donate their kidneys which was influenced by their concerns about the rest of the family as they thought

that donation will have negative effect on the health of the donor.

In conclusion, our study on the epidemiology of CRF in the western area of KSA shows that the profile is similar to other parts of the Kingdom with a predominance of congenital causes. There was a considerable delay in referring CRF children to a pediatric nephrologist as well as a delay in management of preventable causes such as neurogenic bladder associated with spina bifida.

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