

Special Article

Renal Replacement Therapy in Sudan, 2009

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Abstract

Introduction: Despite an early start, the provision of renal replacement therapy (RRT) in Sudan is constrained by economic factors. This report describes the ESRD population and the available renal replacement therapy (RRT) services in Sudan in 2009.

Current status: In June 2009, there were 2858 patients on hemodialysis (HD) in Sudan, 122 patients on continuous ambulatory peritoneal dialysis (CAPD), and 1168 kidney transplant recipients. The overall prevalence of treated ESRD was 106 patients per million population. All forms of RRT were funded by the government. The mean age of HD, CAPD and kidney transplant patients was 46±17, 42±22 and 39±13 years respectively. Males constituted 66%, 67.7% and 79.5% and children constituted 3.9%, 25.3% and 6.6% of HD, CAPD and kidney transplant patients respectively. The commonest reported cause of kidney failure was hypertension (26.1%), followed by diabetes mellitus (DM) (10.4%), obstructive uropathy (7.6%), glomerulonephritis (GN) (5.5%), polycystic kidney disease (2.6%), and pyelonephritis (1.1%). The majority of HD patients (83.8%) are offered twice-weekly HD, 83.6% had a functioning arterio-venous (AV) fistula, 6.4% were positive for hepatitis B virus (HBV) infection, 6.5% were positive for hepatitis C virus (HCV) infection, and 0.7% were positive for both HBV and HCV. Target blood pressure, hemoglobin and phosphorus levels were achieved by 26.5%, 23.1% and 28.5% of HD patients compared to 41.8%, 20.6% and 63.5% of CAPD patients respectively. Kidney transplant recipients had their transplant operation performed in Sudan (33.1%), Egypt (20.7%), KSA (18.2%), Jordan (14.8%), Pakistan (8.4%) and other countries.

Conclusion: The prevalence of RRT in Sudan remains low. Hypertension and diabetes mellitus are the most commonly reported cause of kidney failure.

Keywords: End stage renal disease; Hemodialysis; Kidney transplant; Peritoneal dialysis; Renal replacement therapy; Sudan

The authors declared no conflict of interest

Introduction

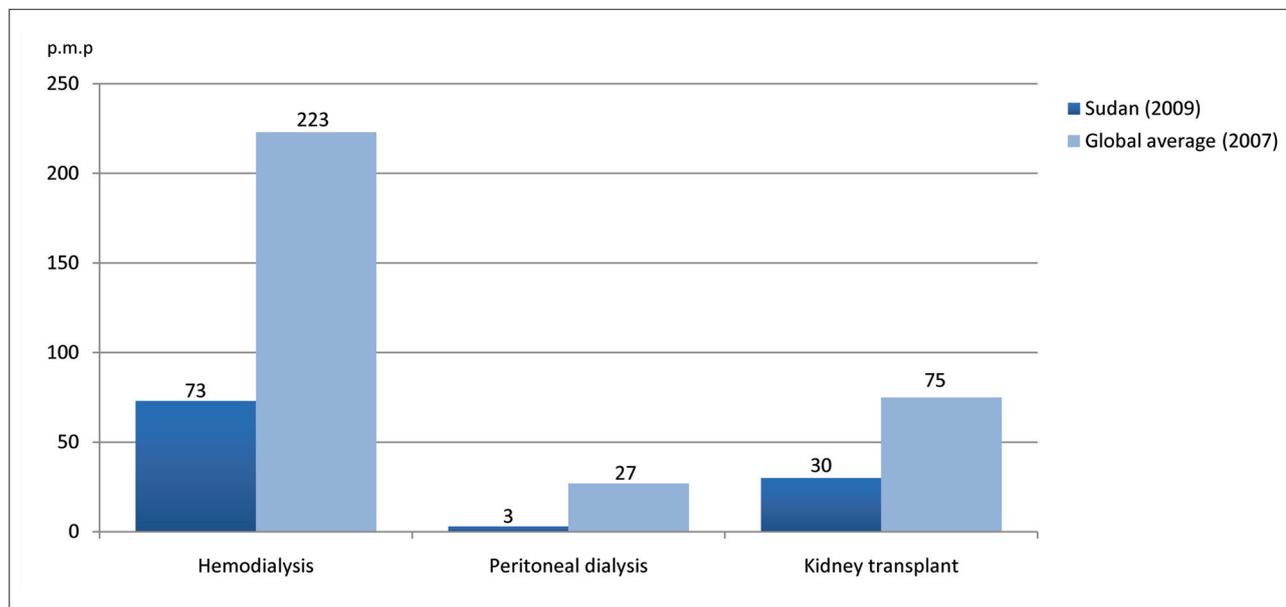
End stage renal disease (ESRD) is a medical and social problem that constitutes a heavy burden on communities worldwide. Increasing global prevalence values of treated ESRD over the years indicate a general increase in the number of kidney failure patients as well as a gradual improvement in the access to the treatment. In 2007, more than 1,6 million patients were undergoing dialysis treatment worldwide, and another half a million patients were living with kidney transplantation [1].

The prevalence of treated ESRD patients in the general population shows a high global variation. In 2007, ESRD prevalence was around 2,300 per million population (p.m.p.) in Japan, around 1,700 p.m.p. in the USA, and about 925 p.m.p. in the European Union. The much lower global average of 325 p.m.p. suggests that access to treatment is still limited in many countries [1].

Intermittent peritoneal dialysis (IPD) was introduced in Sudan in 1968. In the same year, a personal set-up for home hemodialysis (HD) marked the start of HD in Sudan. The first renal unit was opened in Khartoum Teaching Hospital in 1970, where the first kidney transplant in Sudan and the second kidney transplant in the Middle East took place in 1974 [2].

Despite this early start, the provision of renal replacement therapy (RRT) in Sudan lagged behind many neighboring countries. The reasons behind that are mainly economical. The gross domestic product (GDP) per capita in Sudan was 2,086 US\$ in 2007 [3], well below the 10,000 US\$ limit that was noted by global surveys to imply economic restrictions on the prevalence of dialysis treatment [4]. Per capita total expenditure on health at average exchange

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Figure 1: Prevalence of different modalities of RRT in Sudan in 2009 compared with the global averages in 2007 [1]

rate was 37 US\$ in 2007 [5], barely enough to provide for essential health interventions [6].

The National Center for Kidney Diseases and Surgery was established in 1994 and the Sudan Program for Organ Transplantation was launched in 2000 resulting in a relative expansion of RRT in Sudan. In 2005, the Sudan Peritoneal Dialysis Program (Sudan-PD) was established and continuous ambulatory peritoneal dialysis (CAPD) became available for Sudanese ESRD patients.

In this report, we will present a description of the ESRD population and RRT services in Sudan in the year 2009. We hope that it would provide a baseline estimate of various clinical performance indicators, guide continuous quality improvement schemes and help evaluate future progress.

Data collection methods

In June 2009, we conducted a cross sectional survey of all ESRD patients undergoing RRT in Sudan. Data of HD patients were collected simultaneously from all working HD centers by direct patient interviews, with a coverage rate of 93.3%. Data of CAPD patients were provided by Sudan-PD data base. Data of kidney transplant patients were collected by reviewing the pharmacy records and medical records of kidney transplant patients in the four national kidney transplant centers in Sudan, with a coverage rate of 73.4%.

Analysis of the demographic and clinical characteristics of the dialysis population was confined to patients who

were maintained on the respective dialysis modality for 90 days or more, referred to henceforth as prevalent HD or prevalent PD patients.

Prevalence of ESRD and RRT services

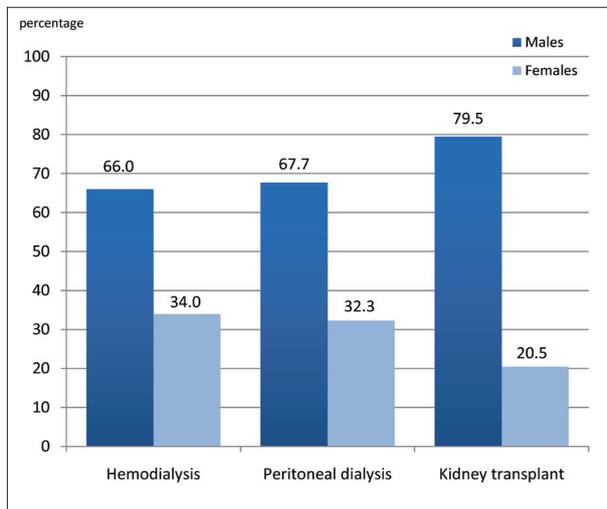
In June 2009, there were 2858 kidney failure patients undergoing HD in Sudan, 122 patients undergoing CAPD, and 1168 patients living with functioning kidney allografts. In a population of 39 millions, these figures yield much lower prevalence rates than the global average in 2007 [1] (Figure 1). No kidney failure patient that reaches hospital is denied dialysis treatment. But it seems likely that large numbers of patients fail to present to hospital and are not diagnosed.

Thus, kidney transplantation represent 28% of RRT in Sudan while HD and PD represent 69% and 3% respectively.

Age and gender of ESRD patients

Prevalent HD patients had a mean age of 46 years (SD 17, range 6-95 years). Prevalent CAPD patients had a mean age of 42 years (SD 22, range 1-81 years). Prevalent kidney transplant recipients (KTR) had a mean age of 39 years (SD 13 years, range 6-80 years).

Males were commoner than females in all modalities, and children aged less than 18 years constituted a small percentage of patients (Figures 2, 3). This male predominance among the ESRD population is a poorly explained almost global phenomenon; with males

Figure 2: Gender distribution in different RRT modalities

constituting 68% of the dialysis population in Egypt, 56.1% in the USA, 60% in UK, and 54.5% in KSA [7-10].

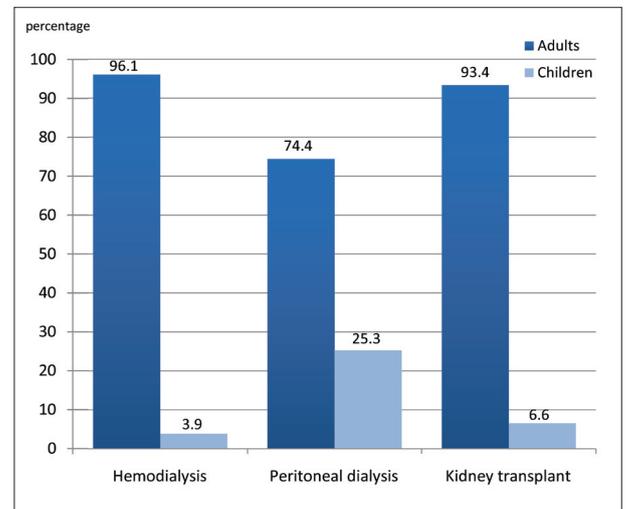
Causes of kidney failure

More than 40% of surveyed patients had no identified cause for their renal impairment. This is expected as most patients present with established kidney failure. The most probable causes of kidney failure in different RRT modalities are shown (Table 1).

Hypertension was the most commonly reported cause of ESRD (26.1%), and this is likely to be an overestimation. The diagnosis of hypertensive nephrosclerosis is difficult to ascertain even in patients with long standing hypertension. Such patients may have had secondary hypertension due to undiagnosed kidney disease.

Glomerulonephritis (GN) was the reported cause in a relatively small proportion of patients, and is probably the true underlying etiology in many of cases currently labeled as "uncertain etiology". The diagnosis of GN is rarely confirmed by renal biopsy, and often relies on the presence of renal impairment, proteinuria or active urinary sediment in the absence of other causes.

In an early description of 100 chronic renal failure patients presenting to Soba University Hospital in Sudan between 1982 and 1984, GN was reported as responsible for 38% of cases, followed by renal calculi (12%), diabetes mellitus (9%), chronic pyelonephritis (7%), sequelae of acute renal failure (5%), renal vascular disease (4%), polycystic kidney disease (3%), and obstructive uropathy not due to renal calculi (2%). In that series, the diagnosis of GN was made on the basis of small smooth kidneys seen radiologically in the intravenous urograms with

Figure 3: Percentage of children in different RRT modalities

the absence of other etiologic factors, and histologic confirmation was obtained for only one third of patients. Only 20% of patients were labeled to have uncertain etiology and those were patients who reached the hospital very ill and died before investigations were completed [11].

In a previous report of 236 patients from two HD centers in Sudan, obstruction and polycystic kidney disease were reported as responsible for a similar percentage of cases (8.5% and 3% respectively), while a higher percentage was reported for GN (6.8%), a lower percentage for DM (5.9%) and a much lower percentage for hypertension (3.8%). In that series 71.2% of cases were labeled to have uncertain etiology [12].

This variation in the reported rates of hypertensive nephrosclerosis and GN probably results from different definitions of these conditions rather than a true variation in prevalence. A similarly wide variation is noted in the reported rates of hypertension as the primary renal diagnosis of ESRD patients in UK and USA (5.8% and 24.3% respectively) [8, 9].

The findings of the current survey are consistent with reports from other African countries, in which hypertension seems to surpass DM as a cause of ESRD. Hypertension was the reported cause of kidney failure in 21% of patients on RRT in the South African Registry, while the contribution of diabetic nephropathy was estimated to be 14-16% [13]. Hypertension accounted for 34.6% of ESRD in Black South African patients, compared to 4.3% in Whites, 13.8% in Indians, and 20.9% in people of mixed ancestry [13].

In an early series of 115 black patients admitted to a chronic HD program in South Africa over a 4-year

Table 1: Causes of kidney failure in different RRT modalities

Cause of renal failure (%)	HD	PD	KTR	ESRD
Uncertain etiology	40.1	32.4	50.8	42.6
Hypertension	27.3	33.8	22	26.1
Diabetes Mellitus	12	14.9	5	10.4
Obstructive uropathy	8.9	4.1	4	7.6
Glomerulonephritis	3.9	6.8	10	5.5
Polycystic kidney disease	2.8	1.4	2	2.6
Pyelonephritis	1.3	0	1	1.1
Others	3.8	6.8	5	4.1

HD: hemodialysis; PD: peritoneal dialysis; KTR: kidney transplant recipient; ESRD: end stage renal disease

period, a definitive pathological diagnosis was made in 70 cases. The cause of ESRD was malignant hypertension in 32 patients (45.7%), chronic GN in 26 patients (37%) and obstructive uropathy in 4 patients (5.7%). Patients diagnosed on clinical grounds only had a similar disease pattern [14].

Thus, the current estimates of the contribution of hypertension as the primary renal diagnosis in our ESRD population seem plausible. On the other hand, GN is likely to have been underestimated.

Approximately 19% of surveyed ESRD patients had a first or second degree relative with renal impairment. In a similar survey that included 4365 HD patients in two states in USA, 20% of patients reported having a first or second degree relative with ESRD [15]. This suggests that close relatives of ESRD patients may benefit from directed screening and preventive efforts.

Hemodialysis

In 1995, there were two HD centers in Sudan with six working machines, all of them in the capital Khartoum, dialyzing 56 patients per week [2].

In June 2009, there were 41 working HD centers in Sudan: 25 governmental centers serving 1789 patients and 16 private centers serving 1069 patients. Thus, governmental and private HD centers served 62.6% and 37.4% of the HD population respectively.

HD services in Sudan are funded by the government, including services provided by private centers. Patients do not pay for their HD sessions. The majority of HD patients (83.8%) in Sudan are offered twice-weekly HD for economical reasons. According to the NKF/KDOQI guidelines twice-weekly HD is not appropriate for patients without significant residual renal function [16].

The total number of kidney failure patients undergoing HD was 2858 patients; 2374 (83.1%) were ESRD patients that had been maintained on HD for 3 months or more, 265 (9.3%) were ESRD patients that had been maintained on HD for less than 3 months, 28 (1%) were ARF patients, and 191 (6.7%) were patients for whom we had no data on dialysis duration.

Only 37.7% of prevalent HD patients were diagnosed to have CKD at least 3 months before dialysis initiation. The majority of patients had a functioning AV fistula (83.6%), while 7.3% had a tunneled HD catheter and 9.1% had a non-tunneled catheter. Non-tunneled catheters were most commonly placed in the jugular vein (80.9%), 18% were placed in the femoral vein and 1.1% in the subclavian vein. This complies with the NKF/KDOQI vascular access guidelines which recommend that greater than 65% of prevalent HD patients have a functional AV fistula [16].

The prevalence of HBV infection was 6.4%, the prevalence of HCV infection was 6.5%, and 0.7% had combined HBV and HCV infection. Two earlier reports estimated the prevalence of HCV infection among a group of HD patients in Sudan to be 23.7% and 34.9% [12, 17]. However, both reports referred to one or two HD centers and do not reflect the general situation.

Due to practical constrains, adequacy measures have little practical value in our setting. Only 17% of prevalent HD patients had a documented measurement of the urea reduction ratio (URR), and only 47% achieved a URR \geq 65%.

The target pre-dialysis blood pressure (BP) of <140/90 mmHg and the target post-dialysis BP of <130/80 mmHg were achieved in only 26.5% of patients. Only 23.1% of patients achieved the target hemoglobin of \geq 11 g/dl. Parenteral iron was used by 69% of patients and

Table 2: Reasons cited by prevalent HD patients for not being evaluated/prepared for kidney transplantation

Reason	Number	%
Patient has no suitable kidney donor	709	42.4
Patient prefers to stay on dialysis	250	15
Patient is still considering the matter	214	12.8
Patient has a medical contra-indication	212	12.7
Financial constrains	110	6.6
Patient not counseled about transplant	81	4.8
Other reasons	95	5.7
Total	1672	100

Table 3: Relation of kidney donor to patients living with a functioning kidney graft in Sudan

Kidney donor relation	Number	%
Brother or sister	395	33.8
Son or daughter	129	11.0
Other related	96	8.2
Mother or father	39	3.3
Live unrelated	174	14.9
No data	335	28.7
Total	1168	100

erythropoietin in any dose was used by 79%. Only 28.5% of patients achieved phosphorus level ≤ 5.5 mg/dl.

Only 19.7% of prevalent HD patients were being evaluated/prepared for kidney transplantation. The most commonly cited reason for not being evaluated for kidney transplantation was lack of a suitable live kidney donor (Table 1).

Peritoneal dialysis

In 1995, there were 15 hospital beds dedicated for PD, all of them in Khartoum, and about 70 ESRD patients were maintained on IPD [2].

There were 122 patients on CAPD in Sudan in June 2009. Cyclical PD is not available yet in Sudan and IPD is only used as a temporary measure. CAPD patients are followed up in eight PD centers. Dialysis fluids are provided for patients free of charge

Among CAPD patients, 99 patients (81.1%) had been on PD for 3 months or more and 23 patients (18.9%) had been on PD for less than 3 months. The commonest cause

for choosing CAPD was patient preference (56%); other reasons were vascular access problems (26%), being medically unfit for HD (8%), being a child less than 5 years old (6%), and the lack of HD facility near the patient's living place (4%).

Only 45.3% of prevalent patients had a documented Kt/V measurement over the previous six months, and 71.8% achieved the target $Kt/V \geq 1.7$. Target BP $\leq 130/80$ mmHg was achieved by 41.8% of prevalent patients. Target hemoglobin ≥ 11 g/dl was achieved by 20.6% of prevalent patients. Target phosphorus level ≤ 5.5 mg/dl was achieved by 63.5% of prevalent patients.

Kidney transplantation

Until 1995, a total of 30 transplants have been performed in Sudan, and there were about 200 kidney transplant recipients in the country. The majority had their operation done in Saudi Arabia (KSA), the rest were done in Egypt, Kuwait, Jordan, India and European countries [2].

The number of ESRD patients with a functioning kidney allograft in June 2009 was 1168 patient. Transplant operations performed within the country are funded by the government, as well as the cost of maintenance immunosuppressive medications for all patients. The proportion of kidney transplants performed inside Sudan was only 33.1%. Transplants performed outside the country most commonly took place in Egypt (20.7%), KSA (18.2%), Jordan (14.8%) and Pakistan (8.4%). All grafts were obtained from live donors, and the majority were from live related donor (Table 3)

Patients were generally maintained on triple immunosuppression; 54.9% were maintained on cyclosporine, while 45.1% were maintained on tacrolimus. Target BP $\leq 130/80$ mmHg was achieved only by 32.9% of patients, and target hemoglobin ≥ 11 g/dl was achieved by 81.5% of patients.

Conclusion

Access to RRT in Sudan has improved over the last two decades, but remains very low. This improvement is mostly due to the government commitment to the treatment of ESRD patients. Hypertension and DM are the most commonly reported causes of kidney failure. One third of patients live with functioning kidney grafts, and the vast majority of the remainder are maintained on HD.

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