Original Article

Clinico-Epidemiological Profile of Dialysis Services in Karnataka, India – A Multicentric Exploratory Study

Arvind Conjeevaram, Y. J. Anupama[1], Lloyd Vincent[2], Nandakumar B. Sastry[3], Vishwanath Siddini[4], Manjunath Revanasiddappa[5], Sanjay Srinivasa[6], Anilkumar B. Thimmegeowda[7], Manjunath J. Kulkarni[8], Vivek S. Patil[9]

Department of Nephrology, Sagar Hospitals, Bengaluru, Karnataka, [1]Department of Nephrology, Nanjappa Hospital, Shivamogga, Karnataka, [2]Director, Africa Healthcare Network, Port Louise, Mauritius, [3]Department of Community Medicine, M. S. Ramaiah Medical College and Hospitals, Bengaluru, [4]Department of Nephrology, Manipal Hospitals, Bengaluru, [5]Department of Nephrology, SDM College of Medical Sciences and Hospital, SDM University, Dharwad, [6]Department of Nephrology, Sapthagiri Institute of Medical Sciences, Bengaluru, [7]Department of Nephrology, BGS Global Gleneagles Hospital, Bengaluru,

Abstract

Introduction: New challenges in dialysis care delivery confront caregivers with the rise in dialysis numbers. There are significant lacunae in the knowledge and efficient application of dialysis therapy in the absence of a dialysis registry. This multicentric study was conducted by the Nephrology Association of Karnataka to systematically study patient demographics and dialysis characteristics in Karnataka state, India, as a basis for a statewide dialysis registry. Material and **Methods:** Data were collected from the consenting dialysis centers after institutional ethics board clearances. Residents of Karnataka state, who were confirmed prevalent patients with end-stage renal disease, on either maintenance hemodialysis (HD) or peritoneal dialysis were included. Demographic data of patients and details of dialysis as well as dialysis facilities were collected on an online platform. Statistical analysis was done using SPSS software Version 16. **Results:** Thirty-two centers contributed to the data of 2,050 patients (males 70.3%, mean age 53.49 ± 14.09 years). Most patients were on HD (95.3%). Diabetes was the commonest cause of chronic kidney disease. About 72% of patients had temporary venous catheters as initial vascular access. In all, 1,156 patients (59.9%) were on thrice weekly HD. Around 65% of the centers were in private hospitals. The majority (90%) of the centers reused dialyzers, 56% reprocessed dialyzers mechanically, and 66% tested viral serology quarterly. **Conclusions:** This study was one of the initial attempts to capture dialysis data across Karnataka, and it offers useful insight into the existing dialysis demographics and care delivery. Participation of more centers and continued effort to form a dialysis registry for deriving meaningful clinico-epidemiological insight are desirable.

Keywords: *Dialysis care delivery, dialysis registry, epidemiologic profile, India, Karnataka, NAK*

Introduction

The burden of chronic kidney disease (CKD) is increasing in India. Data on prevalence are limited and vary widely from 0.9% to 1.3% in some of the earlier studies[1,2] to 4.6% to 17.3% in the more recent population-based studies.[3-5] End-stage renal disease (ESRD) contributes to about 0.8% of all CKD.[5] The incidence of ESRD in India is reported to be 228 per million population, which translates to an average of 300,000 new patients per year.[6] According to the Pradhan Mantri National Dialysis Programme, there is a demand for 30 million additional dialyses every year.[7] Acceptance of renal replacement therapy (RRT) is low with only about 10% of Indian ESRD patients receiving RRT.[8,9] However, the dialysis patient population and the dialysis facilities have increased throughout the country over time. India does not have an established, full-fledged registry for dialysis. There is a lack of systematic data collection regarding the epidemiology and demographics of this important patient population. The available data regarding dialysis patient population are limited to a few single-center studies or to certain select characteristics such as economic considerations.[10]

In Karnataka, a state in the southern part of India, there are more than 200 dialysis centers, with approximately 85% in hospitals and 15% stand-alone centers. About 150 nephrologists in the state manage these centers. There has been a steady rise in the number of patients entering maintenance dialysis programs. In the absence of a registry, a multicentric study involving most of the dialysis centers in the state potentially could provide simple baseline information regarding this important and ever-increasing patient population. The Nephrology Association

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[8]*Department of Nephrology, Father Muller Medical College, Mangaluru,* [9]*Department of Nephrology, Vaatsalya Life Hospital and United Hospital, Kalaburagi, Karnataka, India*

Address for correspondence:
Dr. Y. J. Anupama,
Department of Nephrology, Nanjappa Hospital, Shivamogga, Karnataka, India.
E-mail: anupamayj@gmail.com

of Karnataka (NAK) conducted this cross-sectional pilot study on prevalent dialysis patients with the objective of collecting data regarding dialysis practice pattern as well as individual dialysis centers from all over Karnataka. Learning from this study would be helpful in the creation of a registry model for ESRD for the state.

Materials and Methods

Study design: This study was conducted as an exploratory clinico-epidemiological study.

Study setting and participating centers: All nephrologists belonging to the NAK with active nephrology practice in the state were invited to participate in the study. Those centers willing to participate, contributed to the data as per a uniform protocol framed for the study on an electronic platform (Renalyx), and data were maintained in a cloud-based repository.

Study participants: All prevalent ESRD patients on maintenance dialysis, both hemodialysis (HD) and peritoneal dialysis (PD), with dialysis vintage of more than 3 months were included in this study. Informed written consent was obtained from all patients. Patients who did not give consent, those who were on dialysis for less than 3 months, and those on dialysis for acute kidney injury were excluded from the study. Unlinked, anonymized, and encrypted clinical data form was made available to each participant center. Each center was also anonymized and encrypted for patient as well as institutional privacy. A central data monitoring board of NAK helped the participating centers to input as well as extract data as per the agreed guidelines.

Data collection: Data points that were needed regarding the dialysis facility as well as patient care were collected in a questionnaire format. Information pertaining to the demographics of the patient such as age, gender, educational status, occupation, annual income, and religion was taken. Basic anthropometric data and history regarding dialysis vintage, CKD details, and other comorbidities were obtained. Recent laboratory parameters were recorded. Data regarding the frequency of dialysis, vascular access, viral serology status, and medication details, particularly erythropoietin and iron, were collected. Likewise, information was collected from all existing patients on PD. Facility data were obtained regarding the practice of isolation of the patients for seropositive patients, cost per dialysis, and the practice of reuse of dialyzers and tubings.

Data were collected in a standard electronic format using online entry. A cloud-based electronic repository, Amazon Web Space (AWS) with an online platform for data collection (Renalyx Nephrology Information System©, Bengaluru, India) was used. Space on AWS was hired on a monthly basis by the NAK and data were maintained on AWS for 5 months till all centers could input their data. Thereafter, the AWS account was closed after the data was downloaded to NAK's computers in the form of Excel files.

Ethics clearance: Ethics clearance was obtained from individual institutional ethics committees. All participants were explained about the nature of the study, and informed written consent was obtained from all participants. The subjects were given all information regarding the study, and all the apprehensions were addressed. The anonymity of the subjects was maintained by ascribing a centrally generated code for the patient as well as the center. The study questions were administered during the course of their dialysis or routine visits to the doctor and responses were registered. We assured them that the information will be kept confidential and their care would not be compromised if they refuse to participate in the study. All requisite precautions and care were ensured to comply with the revised Indian Council for Medical Research 2018 guidelines on research involving human subjects.[11]

Data analysis and statistical methods: Data collected from all the centers were subjected to quality assessment as per standard protocols to ensure homogeneity as well as completeness. Statistical analysis was done by using SPSS statistical software (SPSS Version 16, SPSS Inc., Chicago, IL, USA). Measures of central tendency, mean (standard deviation) or median (interquartile range) were computed as necessary. Univariate analysis was undertaken to assess the associations between independent and dependent variables. Independent *t* test was done to compare the means of continuous variables. Chi-square test was done to assess the significance of association for categorical variables. $P < 0.05$ was taken as statistically significant.

Results

This study was conducted between August 2018 and November 2018. Data contributed by 32 (16% of total) centers were analyzed after checking for completeness. Those centers that had given only incomplete data or had not completed the questionnaire were excluded from the analysis.

Demographic details: The study included 2,050 subjects. Of these, there were 609 females (29.7%) and 1,441 males (70.3%). The median age was 55 years with

an interquartile range of 45 to 64 years. The youngest patient in the study group was 10 years old and the oldest was aged 88 years. About one half of the patients were unemployed (50.7%) and were dependent on their family members. Unskilled laborers comprised 12.5% of the population and 6.1% were agriculturists. Most of them had at least high school education; 26% had studied up to high school, whereas 45.8% had some form of a college education. The mean body mass index was 23.68 kg/m^2. The self-reported annual income was less than INR 50,000 (USD 700) in 622 (30.3%) patients, whereas 22.3% reported INR 50,000 to 500,000 (USD 700–7,000) [Table 1].

Kidney disease characteristics: The most common etiology of CKD was diabetes, with 801 (39.1%) patients having diabetic kidney disease [Figure 1]. Chronic glomerulonephritis was the likely etiology in 13.2% and chronic interstitial nephritis in 11.2% patients. Kidney disease related to long-standing hypertension was the underlying cause in 506 (24.6%) patients. The cause for ESRD was not known in 113 (5.5%) patients. Nearly 50% of patients were aware of CKD for more than a year prior to initiation of dialysis with only 4.6% patients diagnosed with CKD Stage 5 at the time of the initiation of dialysis. Cardiovascular disease was noted in 16.6%, cerebrovascular disease in 3.5%, and dyslipidemia in 8.6% of patients. Seropositivity for hepatitis B surface antigen, hepatitis C, and human immunodeficiency virus were 1.5%, 5.9%, and 0.3%, respectively. Three (0.1%) patients were positive for both hepatitis B and C [Table 2].

Dialysis details: Patients on HD vastly outnumbered those on PD. A total of 1,909 patients (95.3%) were on HD and 104 patients (4.7%) were on PD. The details are presented in Table 3. Nearly 60% of patients had a dialysis vintage of more than a year. In all, 999 (54.6%) had been on dialysis for 1 to 5 years, whereas 164 (9.0%) were on dialysis for 6 to 10 years and 51 patients (2.8%) had been on dialysis for more than 10 years [Figure 2]. Financial support for dialysis was nonexistent for more than 50% of patients (53.3%) paying entirely by themselves for their dialysis. There was a government subsidy for 31.8% and a private insurance for 13.6%, whereas 1.3% were supported by charity.

Of the 1,909 patients on HD, 1,378 (72%) had been initiated on dialysis through temporary double lumen

Table 1: Demographic profile of the study participants

Variable	Number	Percentage
Age in years		
<20	24	1.2
21-40	322	15.8
41-60	928	45.7
61-80	721	35.5
>80	37	1.8
Mean (±SD): 53.45 (±14.09)		
Sex		
Male	1,441	70.3
Female	609	29.7
Education		
Primary	575	28.1
Secondary	533	26.0
Preuniversity	442	21.5
College	358	17.4
Postgraduate	142	6.9
Occupation		
Unemployed	1,041	50.7
Unskilled labor	258	12.5
Skilled labor	198	9.6
Agriculturists	127	6.1
Sedentary	304	14.8
Professional	122	5.9
Annual income in INR (USD)*		
<50,000 (<700)	622	30.3
50,000-500,000 (700-7,000)	458	22.3
500,000-2 million (7,000-27,000)	158	7.7
>2 million (>27,000)	40	2
Religion		
Hindu	1,693	82.6
Muslim	118	5.8
Christian	213	10.4
Others	8	0.4

SD=Standard deviation; INR=Indian National Rupee; USD=U.S. Dollar. *772 participants refused to answer the query

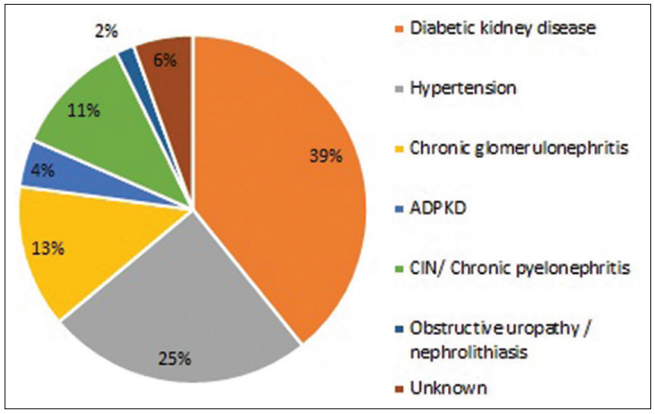

Figure 1: Etiology of chronic kidney disease

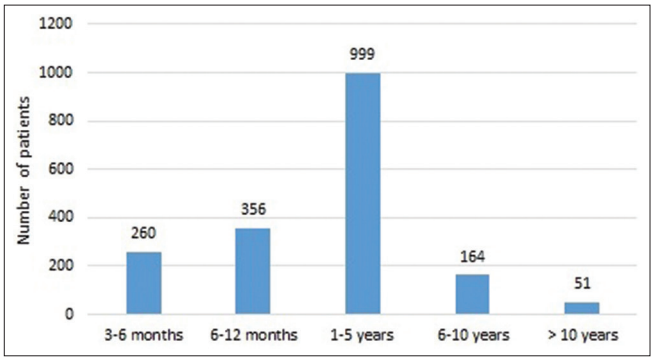

Figure 2: Dialysis vintage of participants

Table 2: Kidney disease characteristics and comorbidities

Variable	*Number*	%
Etiology of CKD		
Diabetic kidney disease	801	39.1
Hypertension	506	24.6
Chronic glomerulonephritis	272	13.2
ADPKD	92	4.4
CIN/Chronic pyelonephritis	230	11.2
Obstructive uropathy/nephrolithiasis	36	1.7
Unknown	113	5.5
Duration of CKD		
3 months	94	4.6
3-12 months	290	14.1
1-5 years	1,192	58.1
6-10 years	324	15.8
>10 years	150	7.3
Comorbidity*		
Diabetes	976	47.6
Hypertension	1,755	85.6
Dyslipidemia	177	8.6
Coronary artery disease	340	16.6
Cerebrovascular disease	72	3.5
Peripheral vascular disease	119	5.8
Retinopathy	469	22.9
Peripheral neuropathy	206	10
Seropositivity status		
BV	31	1.5
HCV	121	5.9
HIV	6	0.3
HBV and HCV	3	0.1

CKD=Chronic kidney disease; ADPKD=Autosomal dominant polycystic kidney disease; CIN=chronic interstitial nephritis ; HBV=hepatitis B virus; HCV=hepatitis C virus; HIV=human immunodeficiency virus. *Many participants had more than one comorbidity. Hence total adds up to more than 2,050

catheters, whereas only 466 (24.3%) were initiated through the arteriovenous fistula (AVF). At the time of this study, the functioning dialysis access was mostly the AVF with 1,691 (87.9%) patients being dialyzed through the AVF and only 66 (3.4%) patients were still being dialyzed through temporary catheters with no permanent access. In all, 59.9% of the patients were undergoing three times a week dialysis, 35.3% twice weekly and 3.4% irregular or once a week dialysis. The duration of dialysis was 4 hours in the vast majority of the HD patients.

Only 104 (4.7%) patients were on PD, of whom just six (5.7%) were using the automated cycler. Most of the patients were performing four exchanges per day. Nearly, 60% of the patients on PD had experienced at least one episode of peritonitis. The route of PD catheter placement was mostly percutaneous, and the commonest reason for opting for PD was patients' choice of PD as a first modality of RRT (61.5%). In 35%, PD was started after failure of HD.

Quality of dialysis and medications: The medians of the laboratory parameters with the interquartile ranges are tabulated in Table 4. The dialysis adequacy metric Kt/V and urea reduction ratio (URR) were assessed in 149 and 437 patients, respectively. Median Kt/V was 1.1 and URR was 67.9%. Most of the patients (79%) were on antihypertensive medications, with more than 20% requiring three or more groups of antihypertensive drugs. In all, 44% were on calcium supplements and 37% were on vitamin D or calcitriol. Nearly, 47% were on the calcium-containing phosphate binders and 41% were on non-calcium binders. Almost all were on some form of erythropoiesis-stimulating agents.

The data were analyzed for gender-specific differences to identify if women were at a disadvantage with respect to dialysis accessibility and continuation. It was seen that females were more often unemployed and poorly educated than males, and this was statistically significant ($P < 0.05$). Women were more likely to undergo PD. Those women undergoing HD were more likely to undergo twice weekly HD and with venous catheters as long-term vascular access [Table 3]. The dialysis vintage and the financial support for dialysis did not differ between the two sexes. The hemoglobin and calcium levels were lower and were consequently on higher doses of ESA and calcium supplements [Table 4].

Infrastructural details for dialysis services

Among the 32 hospitals that participated, 65% of the centers were in private hospitals, whereas five (15%) centers were associated with medical colleges or with government hospitals. In all, 17 (53.1%) of the centers were managed by a single nephrologist at each center, 10 (31.3%) by two to four nephrologists, and five (15.6%) by five or more. One fourth of the centers had more than 20 machines, whereas 37% had 11 to 20 machines. Most of the centers (90%) used bicarbonate-based dialysate. All the centers used reverse osmosis units for water purification. Isolation for hepatitis B virus and human immunodeficiency virus was done in 23 (72%) centers. Isolation for hepatitis C virus was done in 25 centers. Most of the centers (90%) reused dialyzers, whereas 22% centers reused tubings also; 56% reprocessed dialyzers mechanically. Most of the centers (66%) tested viral serology quarterly.

Discussion

The burden of CKD and dialysis is well documented by renal registries in the developed world since decades, but it is largely unknown in the low- and middle-income countries due to lack of national registries.[12] Information from the registries is helpful in many ways. First, it helps understand the regional distribution and the burden of the dialysis population. Second, the patient characteristics, comorbidities and specific complications, and outcomes may be obtained. Third, information can guide changes in

Table 3: Dialysis characteristics

Characteristics	Number	Total Number (%)	Females number (%)	Males Number (%)	*P*
Modality	2,050				
HD		1,946 (95.3)	548 (90.1)	1,397 (97.1)	**0.005**
PD		104 (4.7)	60 (9.9)	44 (2.9)	
Finance for dialysis	1,844				
Self		983 (53.2)	281 (52.1)	702 (53.83)	0.201
Government subsidy		587 (31.8)	174 (32.2)	413 (31.6)	
Private insurance		250 (13.5)	77 (14.2)	173 (13.5)	
Charity		24 (1.3)	8 (1.4)	16 (1.8)	
HD characteristics					
Frequency	1,899				
<2/irregular		65 (3.4)	15 (2.7)	50 (3.7)	**0.04**
2/week		651 (35.3)	217 (38.7)	464 (33.9)	
3/week		1,156 (59.9)	317 (56.5)	839 (61.3)	
>3/week		27 (1.4)	12 (2.1)	15 (1.1)	
Duration of each sitting	1,891				
<4 h		13 (0.7)	4 (0.7)	9 (0.7)	0.142
4 h		1,843 (97.3)	543 (98.4)	1,300 (96.9)	
5 h		35 (1.8)	4 (0.7)	31 (2.3)	
12 h (nocturnal)		3 (0.2)	1 (0.2)	2 (0.1)	
Initial vascular access	1,916				
Temporary venous catheter		1,378 (72)	401 (72.3)	977 (71.9)	0.466
Tunneled catheter		67 (3.4)	18 (3.2)	47 (3.5)	
AVF		466 (24.3)	133 (24)	333 (24.5)	
AVG		5 (0.3)	3 (0.5)	2 (0.1)	
Current vascular access	1,924				
Temporary venous catheter		66 (3.4)	23 (4.1)	43 (3.1)	**<0.001**
Tunneled catheter		113 (5.9)	46 (8.2)	67 (4.8)	
AVF		1,691 (87.9)	464 (83)	1,227 (89.9)	
AVG		54 (2.8)	26 (4.7)	28 (2.1)	
HD vintage	1,830				
3-6 months		260 (14.7)	79 (14.7)	181 (14.1)	0.754
7-12 months		356 (19.5)	108 (20.1)	248 (19.2)	
1-5 years		999 (54.6)	283 (52.6)	716 (55.4)	
6-10 years		164 (9.0)	54 (10)	110 (8.5)	
>10 years		51 (2.8)	14 (2.6)	37 (2.9)	
PD characteristics					
PD vintage	104				
<1 year		45 (43.2)	21 (48.8)	24 (39.3)	0.631
1-3 years		50 (48.1)	18 (41.8)	32 (52.5)	
>3 years		9 (8.7)	4 (9.3)	5 (8.2)	
Mode of initiation	104				
First choice of RRT		64 (61.5)	27 (65.9)	37 (58.7)	0.744
Failure of HD		35 (33.7)	12 (29.3)	23 (36.5)	
Changed after initial HD due to patient choice		5 (4.8)	2 (4.9)	3 (4.8)	
PD catheter insertion	104				
Percutaneous		60 (57.7)	22 (53.7)	38 (60.3)	0.352
Surgical		42 (40.4)	14 (46.3)	23 (36.5)	
Laparoscopic		2 (1.9)	0 (0)	2 (3.2)	
Number of exchanges	104				
3/day		19 (18.3)	5 (12.2)	14 (22.2)	0.196
4/day		85 (81.7)	36 (87.8)	49 (77.8)	
Icodextrin	100	16 (16)	5 (12.2)	11 (86)	0.387
Cycler	104	6 (5.8)	2 (4.9)	4 (6.3)	0.753

Contd...

Table 3: Contd...

Characteristics	Number	Total Number (%)	Females number (%)	Males Number (%)	*P*
Peritonitis	99	59 (59.6)	25 (62.5)	34 (57.6)	0.628

HD=Hemodialysis, PD=Peritoneal dialysis, RRT=Renal replacement therapy, AVF=Arteriovenous fistula, AVG=Arteriovenous graft. Significant *P* values are marked in boldface

Table 4: Biochemical parameters of patients

Characteristics	Number	Total	Females	Males	*P*
Age, years	2,050	53.4±14.1	51.6±13.5	54.2±14.2	**<0.001**
SBP, mmHg	1,845	144.6±18.1	142.3±18.5	145.5±17.8	**<0.001**
DBP, mmHg	1,845	83.1±9.1	82.3±9.1	83.2±9.1	**0.034**
Hemoglobin, g/dL	1,995	9.6±1.7	9.4±1.6	9.7±1.7	**<0.001**
Serum bicarbonate, mmol/L	491	19.7±3.7	19.5±3.9	19.8±3.6	0.502
Serum calcium, mg/dL	1,480	8.3±1.1	8.2±1.3	8.3±1.1	**0.042**
Serum phosphorus, mg/dL	1,426	4.5±1.4	4.5±1.5	4.4±1.4	0.274
Serum cholesterol, mg/dL	402	142.4±36.6	148±35.2	139.5±37.1	**0.027**
Serum uric acid, mg/dL	581	6.2±1.9	6.3±1.8	6.3±2.1	0.991
PTH, pg/mL	333	404.7±346.2	420.8±391	396.9±322.2	0.584
Urea reduction rate	437	67.9±15.5	72.5±12.3	66.1±16.4	**<0.001**
Kt/V	149	1.12±0.16	1.3±0.2	1.1±0.2	**<0.001**
BMI, kg/m^2	1,214	23.7±4.9	24.1±5.3	23.4±4.7	**0.039**

SBP=Systolic blood pressure, DBP=Diastolic blood pressure, PTH=Parathyroid hormone, BMI=Body mass index.Significant differences are marked in boldface

health policy with scope for further improvement in quality of care.

There is no fully functional dialysis registry in India. This results in a huge vacuum in the availability of information of the dialysis patient population and the opportunity for learning from the collective experience of the many nephrologists as well as for improvisations in dialysis delivery. Some reports with information on dialysis facilities and patients are available from parts of India.[13,14] No such studies have hitherto been conducted in Karnataka and consequently, information about dialysis care delivery in this region is nonexistent. This is the first major multicentric study with the collection of data on multiple aspects of dialysis facility as well as dialysis care delivery. The distribution of dialysis facilities is mostly centered in the major cities with distribution becoming sparse in the smaller cities and towns.[14]

The dialysis centers include those in the government as well as the private sector, with the latter predominating. This situation compares well with that reported in several other parts of the country.[10,14,15] There is no uniform government subsidy for ESRD care, and most people have to bear the direct and indirect dialysis expenditures, partly or fully.[15-17] The socioeconomic disparity among people is reflected in the variable accessibility and inequity in dialysis care delivery.

The sociodemographic data of the dialysis patients in our study compare well with the demographic data from other studies with males predominating and with relatively younger patients.[13,18] This was in contrast to the western world where the mean age of dialysis patients is above 60 years. Diabetes is the most common cause of ESRD in our study. This is comparable with the report of the CKD registry of India.[19] This is also consistent with the scenario in several other South Asian countries and the Middle Eastern countries.[18,20] Table 5 shows the comparative figures in the other countries. The most common causes of ESRD in our patients were diabetic nephropathy, hypertensive nephrosclerosis, and chronic glomerulonephritis (39.1, 24.6 and 13.2%, respectively), The etiology was unknown in 5.5% patients. Although there are reports of CKD of uncertain etiology in certain parts of India occurring at a relatively younger age group, it has not been reported from Karnataka.[23] In addition, studies have suggested that diabetes and other glomerular diseases occur at a younger age and progress rapidly in Indian patients.[24,25] This may explain the younger group of patients in our study.

HD is the preferred RRT in India,[14,26] and the same is reflected in this study too. Although PD is better for rural patients with a lack of accessibility to urban HD centers, lack of insurance coverage and relatively high recurring expenditure make PD a less attractive alternative. The fear of unsupervised therapy and the small, crowded houses with the inability to maintain clean rooms for performing PD also play a role in creating this imbalance with HD weighing over PD. Nephrologists' preference for HD over PD is another important factor for this disparity.[27] HD is the preferred modality in Japan and Korea too, with HD done in 97% and 79% CKD Stage 5 patients, respectively.[21,22]

Table 5: Comparative data of different studies

Characteristics	NAK study, %	Japan, %	Korea, %	GCC, %	North America, %	Europe, %
Mean age, years	53.4	66.5	59.8	54.4	63.4	66.7
Gender, male	70	62	58	56	57	61
Diabetes as a cause of ESRD	39	45	40.8	41	43	25
Hypertension as a cause of ESRD	24	11	19.7	31	26	19
BMI	23.8	NA	22.1	26.3	28.5	26.2
HD	95.3	97	79	90	88.2	NA
PD	4.7	3	7	10	9	NA
AVF as prevalent access	82.5	NA	80	90	60	NA
Venous catheter	8.7	NA	11	10	20	NA
HBV	1.5	NA	6	1.4	NA	NA
HCV	5.9	NA	4	4.7	NA	NA

ESRD=End-stage renal disease, BMI=Body mass index, HD=hemodialysis, PD=peritoneal dialysis, AVF=arteriovenous fistula, HBV=Hepatitis B virus, HCV=Hepatitis C virus, NAK=Nephrology Association of Karnataka, GCC=Gulf Co-operation Council; NA=not available. Adapted from AlSahow *et al*.,[20] Hanafusa *et al*.,[21] and Jin[22]

In our study, 72% were initiated through temporary venous catheters. Most of them later changed to AVF, and a small percentage converted to arteriovenous grafts (AVGs) and tunneled venous catheters. The NKF-KDOQI (National Kidney Foundation–Kidney Disease Outcomes Quality Initiative) guidelines recommended early placement of AVFs in 1997,[28] a policy later formulated as fistula first breakthrough initiative.[29] However, this has not become the standard practice even after two decades, and the rate of initiation of hemodialysis through AVF is still variable across the globe [Table 5]. The temporary vascular access with its attendant risks of infection, thrombosis, and inflammation likely affects the patient's morbidity and mortality. The DOPPS (Dialysis Outcomes and Practice Patterns Study) data also indicate that in the United States and the United Kingdom, nearly 50% to 60% start dialysis through the temporary venous lines, whereas in the other European countries (e.g. Spain and Germany), it is much lower, 24% and 15% respectively.[30] Likewise, these countries have AVF as the vascular access in at least 80% of prevalent dialysis patients, whereas the rates are lower in the United States, and only 24% of patients have AVF according to the DOPPS I data, which increased to only 47% in the DOPPS III data.[30-32] AVG was noted in 29%. The vascular accesses used at initiation and in prevalent dialysis patients remain almost the same in the United States till recently. Catheters are used at initiation in nearly 80%, and AVF is the access in 60% prevalent dialysis patients.[33] Comparative figures for AVF and vascular catheter in prevalent patients from the Korean registry are 80% and 11%, respectively.[22] However, in our study, AVF is the commonest long-term vascular access with 87.9% of patients having AVF as the current vascular access. Nearly 9% have either temporary catheter or tunneled catheter as their current vascular access at the time of this study. One notable difference that we noticed in studies from other countries is the relatively short dialysis vintage in our patients. Only 11.8% had a dialysis vintage of more than 5 years. The Japanese registry recorded that 7.6% patients had a vintage exceeding 20 years. The data from the Korean dialysis registry suggest that 46% of HD patients and 45% of PD patients had been undergoing dialysis for >5 years. Patient dropout from dialysis owing to non-affordability and lack of financial support affects dialysis vintage. Accessibility of dialysis units is another issue as 70% of Indian population resides in the villages. Patients often have to travel long distances as the dialysis centers are located mostly in major cities, and this is another factor affecting vintage. The life expectancy of the population as a whole is rising, as is the prevalence of diabetes, hypertension, and CKD. The accessibility to the dialysis units has only recently increased as more dialysis centers are being started both by the Karnataka government and private hospitals, and this also could also contribute to short dialysis vintage.

Our study has several strengths. This is the first multicentric study from South India and records several parameters covering demographics, kidney disease parameters, comorbidities, biochemical parameters, and treatment modalities, which gives useful information regarding dialysis practice patterns in this part of the country. This could and should progress to periodic analyses in the future and a registry formation that translates to improvements in existing care and dialysis delivery. Online data capture and data storage were unique features that helped in the ease of study. It was also cost-effective as the expenditure involved for data storage for the period of the study was only INR 18,800 (~USD 250).

The study has a few limitations. This is a cross-sectional assessment, and hence these data do not give us information regarding the course of the patients' disease, the attendant morbidity, and mortality. Furthermore, as it is an exploratory study, the results are qualitative, the interpretation of which may be judgmental and biased. Second, the data were limited, as only 32 centers (out of more than 200) contributed to the data. This provides a direction and gives an idea regarding the locoregional

dialysis population but may not be accurately extrapolated for a generalized population, even within Karnataka. Many nephrologists did not provide data due to work pressure and required multiple reminders and revision of deadlines. Nonuniform data entry was a significant problem that required multiple efforts at clarification, and by this, we could identify many areas in the data form that needed clarity and could be improved in the future. Inadequate data maintenance and monitoring could be identified among centers that need improvisation.

Conclusions

In this first multicentric clinico–epidemiologic study on prevalent dialysis patients from Karnataka, it was noted that HD was the commonest dialysis modality and more than two thirds did not have functional AVF at the time of initiation of HD. The most common cause for ESRD was diabetic kidney disease. Most patients undergo twice weekly dialysis, have a short dialysis vintage, and are mostly unsupported financially. Provision of financial subsidies by the government, better management of CKD with early placement of AVF, and clinical audit in dialysis centers are necessary to improve dialysis outcome and patient health.

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Author contributions

AC conceptualized the study and contributed to study design, data acquisition, data analysis, and manuscript editing. AYJ designed the study and contributed to data acquisition, data analysis, manuscript writing, manuscript editing. LV contributed to study design and logistic support to the data collection. NBS performed data analysis, and contributed to study design and manuscript editing. VS, MR, SS, ABT, MJK, and VP helped with data acquisition and manuscript editing. ABT and SS helped with financial support through NAK.

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Conflicts of interest

There are no conflicts of interest.

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Appendix: The following nephrologists have contributed the data to the study:

- Anilkumar B. T., BGS Gleneagles Global Hospitals, Bengaluru
- Anupama Y. J., Nanjappa Hospital, Shivamogga
- Aravind C., Bengaluru Hospital, Bengaluru, Agadi Hospital, Bengaluru, People Tree Meenakshi Hospital, Bengaluru
- Dayanand A. S., Max Hospital, Shivamogga
- Debashish Mahapatra, Command Hospital AF, Bengaluru
- Dilip Rangarajan, NU Hospitals, Bengaluru
- Girish Vakrani, Vydehi Institute of Medical Sciences and Research Centre, Bengaluru
- Girish Nyamgondlu, KMYF D. R Ranka Dialysis Centre, Bengaluru
- Jyothi Hebbur, Sagar Hospital, Banashankari, Bengaluru
- Manjunath Doshetty, Aarogya Hospital, Bidar, BRS Dialysis Unit, Kalaburagi, Chirayu Hospital, Kalaburagi
- Manjunath J Kulkarni, Father Muller Medical College Hospital, Mangalore
- Manjunath Revanasiddappa, SDM College of Medical Sciences and Hospital, Dharwad
- RamMohan Bhat, Narayana Hrudayalaya, Bengaluru
- Ravindra Prabhu, Kasturba Medical College Hospital, Manipal
- RenukaSatish, St John's Medical College Hospital, Bengaluru
- Sanjay Srinivasa, CKD Yelahanka, Bengaluru, CV Raman Government Hospital, Bengaluru, K C General Hospital, Bengaluru, Sanjay Gandhi General Hospital, Bengaluru, Sapthagiri Medical College Hospital, Bengaluru, Suguna Hospital, Bengaluru
- Sanjeev Hiremath, D G Hospital, Bengaluru, Prashanth Hospital, Bengaluru, Promed Hospital, Bengaluru, Sagar Hospital, Jayanagar, Bengaluru
- Suma, Narayana Mutispeciality, HSR Layout, Bengaluru
- Vishwanath Siddini, Manipal Hospitals, Bengaluru
- Vivek S Patil, Patil Multispeciality Hospital, Kalaburagi