

ORIGINAL ARTICLE

Vascular access in Senegalese patients starting chronic haemodialysis

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ABSTRACT

Introduction: It is recommended that patients should start chronic haemodialysis using an arteriovenous fistula (AVF). We aimed to determine the proportion of Senegalese patients who used an AVF at the start of haemodialysis and examined the factors associated with its use.

Methods: We conducted a cross-sectional study from 1 June 2021 to 2 October 2021 among patients on chronic haemodialysis in 10 centres in the Dakar and Thiès regions. Clinical and laboratory data were collected from medical records and also via patient interviews.

Results: The patients (n = 543) had a median age of 50 years [interquartile range (IQR) 40–62 years] and 50.6% were male. The socio-economic level was low in two-thirds of cases. The median duration of haemodialysis was 40 (17–76) months. Hypertension was noted in 92% and diabetes in 13%. Hypertensive kidney disease was the cause of kidney failure in 33%. Only 47 patients (9%) had started dialysis using an arteriovenous fistula. Factors associated with its use at haemodialysis initiation were socio-economic level (OR 0.48; 95% confidence interval (CI) 0.25–0.94 for low socio-economic level) and duration of pre-dialysis follow-up by a nephrologist for >4 months (OR 7.82; 95% CI 3.05–26.50). In 65% of prevalent patients, the vascular access used was an AVF, a tunneled central venous catheter in 28%, an arteriovenous graft in 2% and a temporary central venous catheter in 4.4%.

Conclusions: The proportion of Senegalese patients with an AVF at the start of haemodialysis was low. AVF use was associated with socio-economic level and pre-dialysis follow-up by a nephrologist for >4 months.

Keywords: arteriovenous fistula; arteriovenous graft; haemodialysis catheter; Senegal.

INTRODUCTION

Chronic kidney disease (CKD) is a public health problem worldwide due to its prevalence, mortality, complexity and cost of management [1–4]. If kidney replacement therapy (KRT) is required, then haemodialysis, peritoneal dialysis and kidney transplantation are the different therapeutic modalities. Haemodialysis is the most widely used worldwide, and this is also the case in Senegal [5].

The adequacy of haemodialysis depends on good vascular access [6]. The types of access include native arteriovenous fistulae (AVFs), arteriovenous grafts (AVGs), temporary central venous catheters (CVCs) and tunneled CVCs [7]. An AVF is preferred in patients on chronic haemodialysis

and in whom kidney transplantation is not envisaged in the short term [8]. Several studies have shown that AVF use, as compared to other types of vascular access, is associated with fewer infections, fewer cardiovascular events and better survival [9–11]. The creation of an AVF prior to starting haemodialysis depends on early referral to a nephrologist, patient education and the availability of a vascular surgery service [6].

In Senegal, two relatively small studies have reported a low rate of AVF use at the start of haemodialysis [12,13]. It is also possible that survivor bias led to an overestimation of AVF use in these studies. Given the importance of

the regular evaluation of our practices, we conducted this multicentre study to assess the proportion of patients using an AVF at haemodialysis initiation and to identify factors associated with its use. A secondary aim was to document the type of vascular access in our prevalent patients.

METHODS

This study was conducted from 1 June to 2 October 2021 at the 10 dialysis centres in the Thiès and Dakar regions of Senegal. We included all patients who were stable on chronic haemodialysis for at least three months and were willing and able to provide written consent.

Data were collected from patient interviews and medical records using a standardised, predefined form. The data collected included socio-demographic and clinical data, including information on the primary kidney disease, comorbidities, pre-dialysis follow-up, the initiation of KRT, and data required to assess the socio-economic level according to the socio-economic position index (SEPI). Data on vascular access was captured as it related to the start of dialysis and also the current (prevalent) access.

Definitions

A preemptive AVF is one created before the start of haemodialysis and scheduled haemodialysis was defined as a first haemodialysis session, which was electively planned by mutual agreement between the nephrologist and the patient. Hypertensive kidney disease was diagnosed on clinical criteria. Socio-economic level was defined by the SEPI, a composite measure based on data for age, level of education and professional category. Educational level and occupational category were scored according to the International Standard Classification of Education [14] and the International Standard Classification of Occupations [15], respectively. Socio-economic level was considered low if the SEPI was between 1 and 54, moderate if between 55 and 80, and high if greater than 80 [16]. For patients below the age 25 years, the highest SEPI of the parents was used.

Data analysis

Data entry was performed with Sphinx software and data analysis with R version 4.1.2. Qualitative variables were summarised as numbers and percentages and compared using chi-squared or Fisher's exact tests. Numerical variables were summarised using median and interquartile range (IQR), and groups compared using Wilcoxon rank-sum tests. The patients who began dialysis with an AVF were compared with those using CVCs with respect to factors potentially associated with AVF use. A multivariable, backward logistic regression model was used which included

variables with a P value ≤ 0.10 on bivariate analysis. Age, sex and socio-economic level were also included in the model. Age and body mass index (BMI) were tested as continuous and also as categorical variables (quartiles for age and WHO classification for BMI). We tested for any interaction between low socio-economic level and pre-dialysis follow-up by a nephrologist. Adjusted odds ratios (ORs) and their 95% confidence intervals (95% CI) were determined for each variable retained in the final model. The goodness of fit of the models was evaluated by the Akaike information criterion (AIC). Calibration of the final model was tested by the Hosmer–Lemeshow test and multicollinearity by the variance inflation factor (VIF). P values less than 0.05 were considered statistically significant.

Ethical considerations

This study received approval from the Research Ethics Committee of the Cheikh Anta Diop University of Dakar (reference number 077/2021/CER/UCAD).

RESULTS

All 10 haemodialysis centres in the Dakar and Thiès regions were included (4 private and 6 public). Of the 551 patients treated with chronic haemodialysis in these centres, 543 (98.6%) provided written consent and were included in the analysis. Table 1 illustrates the socio-demographic and clinical characteristics of the participants. Their median age at the start of haemodialysis was 46 years (IQR 35.0–57.0 years) and 50.6% were male. Hypertension was present in 92% and diabetes in 13%. Hypertensive kidney disease was recorded as the cause of kidney failure in 33%. Socio-economic level was low in two-thirds and follow-up by a nephrologist before the start of haemodialysis had occurred in 81%.

At haemodialysis initiation, only 47 patients (9%) were using an AVF, and 83% were using a temporary CVC (Figure 1). The fistula was radiocephalic in 33 patients (69%), brachiocephalic in 11 patients (22.9%) and brachio basilic in 3 patients (6%). One patient had a brachioradial graft.

Table 2 shows the factors associated with haemodialysis initiation using an AVF on bivariate analysis. Table 3 reports a multivariate analysis which was performed on those participants with complete data and included in the multivariate analysis ($n = 426$).

In the multivariable analysis (Table 3), patients who had been followed up by a nephrologist for at least four months were much more likely to start haemodialysis with an AVF (OR 7.82; 95% CI 3.05–26.50) compared to those who had not. On the other hand, those patients at a low socio-economic level (compared to those with a moderate or

Table 1. Characteristics of 543 Senegalese patients starting chronic haemodialysis. Values are median (interquartile range) or number (percentage).

Characteristic	Value
Age (years) [n = 532]	46 (35–57)
Body mass index (kg/m ²) [n = 491]	21.5 (19.4–24.6)
Male sex	275 (51)
Socio-economic level	
Low	362 (67)
Medium	109 (20)
High	72 (13)
Comorbidities	
Hypertension	499 (92)
Diabetes mellitus	70 (13)
Heart disease	65 (12)
Peripheral vascular disease	33 (6)
Stroke	19 (3.5)
Smoking	
Current smoker	0
Ex-smoker	77 (14)
Non-smoker	466 (86)
Primary kidney disease	
Hypertensive kidney disease	179 (33.0)
CKD cause unknown	200 (36.8)
Glomerulonephritis	59 (10.9)
ADPKD	34 (6.3)
Diabetic nephropathy	32 (5.9)
Tubulointerstitial disease	25 (4.6)
Pre-dialysis nephrologist follow-up	439 (81)
<4 months	181 (41)
≥4 months	258 (59)
Transition from another modality	42 (7.7)
Peritoneal dialysis to haemodialysis	40 (7.4)
Transplant to haemodialysis	2 (0.4)
Emergency haemodialysis	367 (68)
Vascular access	
Arteriovenous fistula	47 (8.7)
Arteriovenous graft	1 (0.2)
Temporary CVC	453 (83.4)
Tunnelled CVC	42 (7.7)
Site of temporary CVC	453 (83.4)
Right femoral vein	314 (69.3)
Left femoral vein	120 (26.5)
Right internal jugular vein	17 (3.8)
Left internal jugular vein	2 (0.4)
Public sector	401 (74)

Abbreviations: CVC, central venous catheter; ADPKD, autosomal dominant polycystic kidney disease.

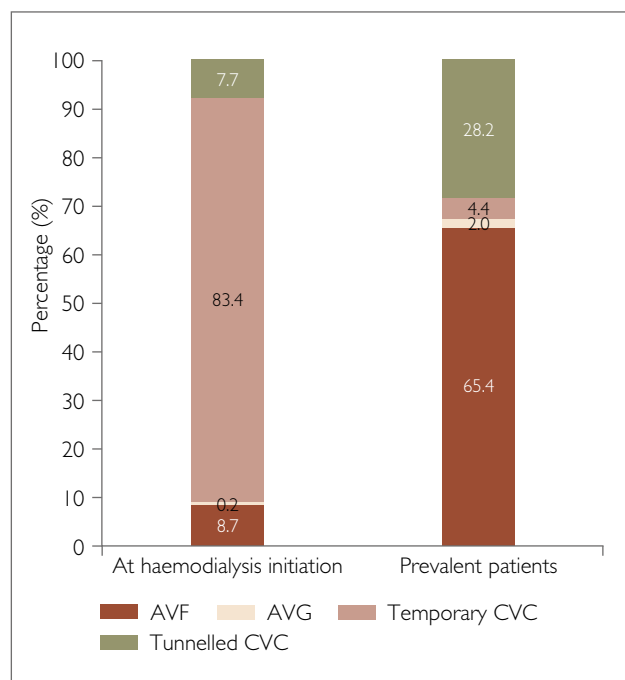


Figure 1. Vascular access at haemodialysis initiation and in prevalent patients.

Abbreviations: AVF, arteriovenous fistula; AVG, arteriovenous graft; CVC, central venous catheter.

distribution of vascular access type in prevalent patients was quite variable across different treatment centres, as illustrated in Figure 2.

DISCUSSION

In our study, which included the majority of the patients on chronic haemodialysis in Senegal, haemodialysis was started with an AVF in only a very small proportion of patients, consistent with data in the African literature [12,16–20]. Numerous studies have reported that the initiation of haemodialysis using catheters is associated with excess mortality, compared with using an AVF [21]. Pre-dialysis follow-up by a nephrologist was strongly associated with preemptive AVF creation in our study, as previously reported in the literature [22–24]. The low rate of AVF usage may be due to several factors, including late decision making by the nephrologist, patients’ reluctance to start dialysis because of the high out-of-pocket costs, and surgical delays in creating the AVF. Senegal has only one surgery department that offers the service of creating an AVF and waiting times are long, as the demand is high. Compared to previous studies conducted in Senegal [12,13], our practices have not improved in terms of preemptive AVF creation. Despite a relatively high rate of pre-dialysis follow-up by a nephrologist, two-thirds of first haemodialysis sessions were performed as an emergency, because of the aforementioned factors.

high socio-economic level) were less likely to start haemodialysis with an AVF (OR 0.49; 95% CI 0.25–0.95).

In prevalent patients, the median duration of haemodialysis was 40 months (17–76 months). Two-thirds (65%) were using an AVF and 28% a tunnelled CVC (Figure 1). Among 543 patients, 79% had received an AVF during haemodialysis follow-up with a median delay of 6 (4–12) months. The

Table 2. Bivariate analysis of factors associated with vascular access type at haemodialysis initiation.

Characteristic	AVF (N = 47)	CVC (N = 495)	P value
Age (years)	51.0 (43.0–59.0)	45.0 (34.0–56)	0.014
Age group (years)			0.053
<35	6 (12)	(25)	
35–46	8 (17)	122 (25)	
46–57	17 (36)	118 (24)	
≥57	16 (34)	121 (25)	
Missing data	0	11	
Male sex	18 (38)	257 (52)	0.074
Body mass index (kg/m ²)	22.2 (20.2–25.8)	21.5 (19.4–24.5)	0.200
Weight			0.200
Underweight	5 (12)	81 (18)	
Normal weight	26 (61)	265 (60)	
Overweight	7 (16)	78 (18)	
Obese	5 (12)	19 (4.3)	
Missing data	4	52	
Low socio-economic level	23 (49)	339 (69)	0.007
Hypertensive kidney disease	14 (29.8)	162 (32.7)	0.700
Diabetic kidney disease	3 (6.4)	29 (5.9)	0.800
ADPKD	8 (17.0)	25 (5.1)	0.005
Hypertension	39 (83.0)	460 (92.9)	0.024
Diabetes mellitus	6 (12.8)	64 (12.9)	>0.900
Heart disease	7 (14.9)	58 (11.7)	0.500
Pre-dialysis nephrologist follow-up	47 (100)	391 (79)	<0.001
Duration of pre-dialysis nephrologist follow-up			<0.001
<4 months	4 (8.5)	177 (45.4)	
≥4 months	43 (92)	213 (55)	
Missing data	0	105	
Emergency dialysis	(0)	367 (74)	<0.001
Transfer from peritoneal dialysis	3 (6.4)	37 (7.5)	>0.900

Abbreviations: ADPKD, autosomal dominant polycystic kidney disease; AVF, arteriovenous fistula; CVC, central venous catheter.

Table 3. Multivariable analysis of factors associated with arteriovenous fistula use when starting chronic haemodialysis. This analysis compared 47 patients using an AVF with 379 patients using a central venous catheter.

Characteristic	OR	95% CI	P value
Female sex	1.64	0.85–3.23	0.150
Low socio-economic level	0.49	0.25–0.95	0.035
Kidney disease other than ADPKD	0.49	0.20–1.32	0.140
Not hypertensive	2.02	0.77–4.88	0.130
Predialysis nephrologist follow-up ≥4 months	7.82	3.05–26.5	<0.001

Abbreviations: OR, odds ratio; ADPKD, autosomal dominant polycystic kidney disease.

authorities should reimburse all dialysis-related care, decentralise vascular surgery services and strengthen universal health coverage. The finding of the association of pre-dialysis follow-up by a nephrologist and AVF usage suggests that it is important to identify patients at risk of kidney failure and arrange earlier referrals to a nephrologist.

The association of low socio-economic level with poor rates of AVF usage is not surprising. Most Senegalese patients have no social security or medical insurance and face enormous difficulties in meeting the direct and indirect costs associated with KRT, including the creation of the AVF. In most cases, patients start KRT in the private sector as the capacity in the public sector is very limited. A recent review describes the organisation of dialysis in Senegal in more detail [5].

The main limitation of this study is its retrospective nature. Selection bias is possible because only surviving patients were included in the study. Because the number of patients

To increase the proportion of patients with an AVF at the start of haemodialysis, the preparation for KRT must be begun early, during CKD stage 4, and must include patient education and shared decision making [7,8]. Health

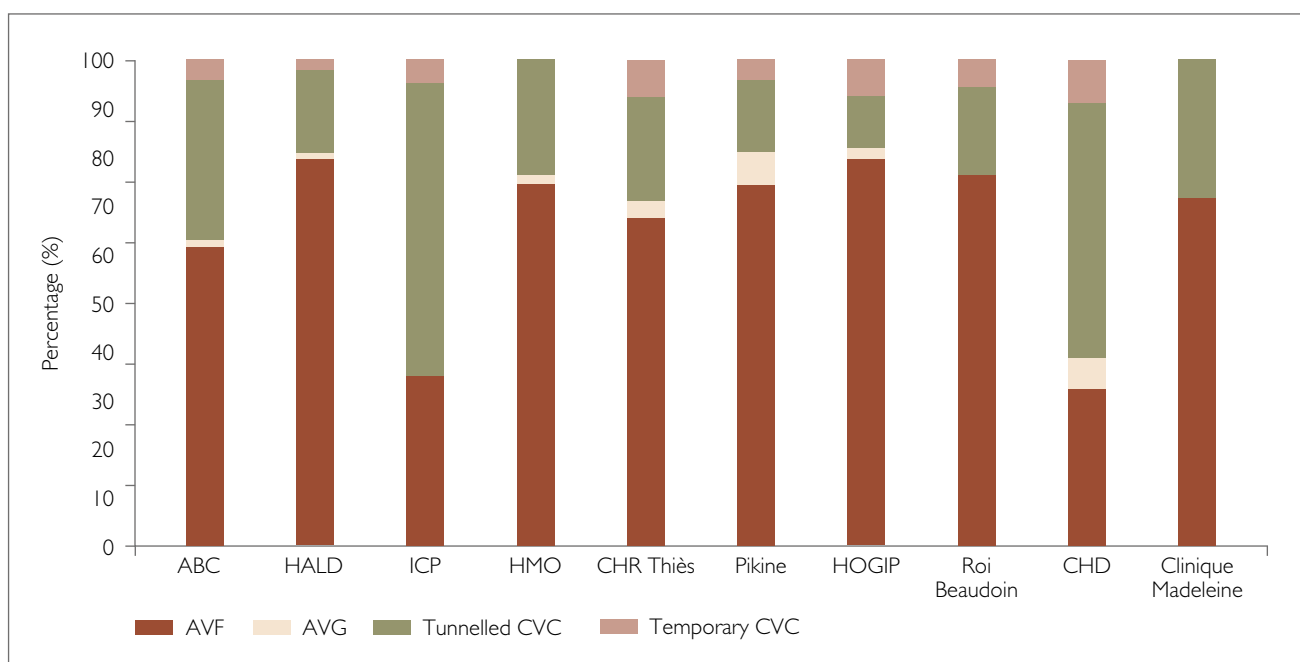


Figure 2. Distribution of vascular access type in prevalent haemodialysis patients by haemodialysis centre.

Abbreviations: AVF, arteriovenous fistula; AVG, arteriovenous graft; CVC, central venous catheter; ABC, Aliou Badara Cissé (private); HALD, Aristide Le Dantec Hospital; ICP, Clinical Institute of Perfection (private); HMO, Ouakam Military Hospital; CHR Thiès, Thiès Regional Hospital; HOGIP, Idrissa Pouye General Hospital; CHD, Dakar Haemodialysis Center (private).

with an AVF is small, the estimates are not very precise and have wide confidence intervals. Furthermore, the instrument used to measure socio-economic level has not yet been validated in Senegalese populations.

CONCLUSION

In conclusion, the rate of AVF usage by Senegalese patients starting haemodialysis was low. Rates of AVF usage were higher in patients who had pre-dialysis follow-up by a nephrologist for at least four months, and in those with higher socio-economic status.

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Conflict of interest

The authors have no conflict of interest to declare.

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