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Outcomes of Hemodialysis Patients in Public Centres in Abidjan from September 2018 to October 2021: Data from the Renal Registry of Cote d'Ivoire

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Abstract

Background: Hemodialysis is the most widely used renal replacement therapy in developing countries such as Cote d'Ivoire. **Objective:** To study the outcome of chronic hemodialysis patients in public centres in Abidjan using data from the Renal Registry of Cote d'Ivoire (2RCI). **Method:** This was a prospective analytical cohort study of End Stage Kidney Disease (ESKD) patients undergoing iterative hemodialysis in the network of public hemodialysis centres in Abidjan and who had been registered in the 2RCI register by September 2018. **Results:** Our study involved 363 cases out of 379 patients registered in the 2RCI registry database in 2018. The mean age of the patients was 47.3 ± 12.1 years, with a male predominance (sex ratio 1.97). In 70.24% of cases, they had no health insurance. The average duration of dialysis for our patients was 6.94 ± 4.1 years, with extremes of 2 and 28 years. This duration was less than 5 years in 44.3% of cases, between 6 and 10 years in 42.9% and more than 10 years in 12.6% of cases. The comorbidities found were hypertension in 95.6% of cases, diabetes in 7.8% and HIV in 4.6%. Anemia was found in 68% of cases and stroke in 8.6%. During the study period, 161 deaths were observed, representing a mortality rate of 44.35%. Acute lung oedema (29.8%), stroke (6.8%) and other cardiovascular diseases (19.3%) were the main causes of death. In multivariate analysis, factors such as age ≥ 65 years (HR = 3.66; CI 95% = 1.55 - 8.67; $p = 0.003$), "married/coupled" status (HR = 2.02; CI 95% = 1.24 - 3.31; $p = 0.005$) and normal weight at the start of dialysis (OR = 9.59, CI95% = 4.19 - 21.95; $p = 0.001$) were associated with the risk of death. **Conclusion:** Hemodialysis is performed in Abidjan on

young patients. The mortality rate after three years of dialysis is very high. Hence the need to pursue the policy of decentralizing public centres and optimizing access to dialysis in terms of quality and quantity in order to improve patient survival.

Keywords

Chronic Hemodialysis, Death, Renal Registry, Cote d'Ivoire

1. Introduction

Chronic kidney disease (CKD) is a major contributor to morbidity and mortality worldwide. In the Global Burden of Disease study, an estimated 956,200 people died from CKD in 2013, an increase of 134% since 1990 [1] [2]. This is one of the biggest increases among the main causes of death. Moreover, even in the early stages of chronic kidney disease, the risk of fatal and non-fatal cardiovascular events attributable directly to kidney disease increases substantially [1].

At the end-stage of the disease, the alternatives available to ensure renal replacement are renal transplantation and dialysis. It is estimated that, worldwide, more than 1.4 million people with end-stage Kidney disease receive renal replacement therapy by dialysis or transplantation, with an annual growth rate of 8% [3]. While transplantation seems difficult to implement in developing countries, dialysis, and in particular hemodialysis, is the most widespread form of renal replacement therapy worldwide. The technique was introduced in Cote d'Ivoire in 1976. And since 17 October 2012, Decree No. 2012-1007 has created and organized the National Centre for the Prevention and Treatment of Renal Insufficiency (NCPTRI), the Ivorian state body responsible for the policy of prevention and management of kidney disease in our country. It currently has ten public centres, four of which are in Abidjan and the rest scattered throughout the country's other cities.

While many developing countries, such as Cote d'Ivoire, have acquired proven experience in hemodialysis, the current challenges remain in the quality and life expectancy of dialysis patients. These notions are not always taken into account in the management of hemodialysis patients and deserve to be evaluated. We therefore felt it relevant to measure these two concepts in public hemodialysis practice in Cote d'Ivoire using data from the Renal Registry of Côte d'Ivoire (2RCI).

This cohort involved the first hemodialysis patients included in the said register. They were followed for a period of three years, until October 2021. The general objective was to study the outcome of these chronic hemodialysis patients, specifically to describe the sociodemographic, clinical and paraclinical characteristics of the patients, to describe the evolutionary aspects and to identify the factors associated with the risk of death.

2. Material and Method

This was a prospective analytical cohort study of ESKD patients undergoing iterative hemodialysis in the network of public hemodialysis centres in Abidjan and who had been registered in the 2RCI in September 2018. The study period extended from August 2021 to October 2021. Only the Cocody, Treichville, Adjamé and Yopougon centres located in Abidjan and under the authority of the National Prevention and Treatment Centre were selected. The patients concerned were part of the 2RCI database created in 2018 by the Ivorian Society of Nephrology. However, we took care not to include patients who had left the network of public centres due to travel outside of the country and those lost to follow-up.

The variables studied were:

- Socio-demographic data: date of entry into dialysis, age, sex, marital status, profession, place of residence, level of education, social security coverage, dialysis centre.

- Clinical data: history and co-morbidities (diabetes, hypertension, smoking, pericarditis, tuberculosis, arteriopathy of an inferior member, stroke, coronary insufficiency, walking ability), weight at the end of dialysis, anemia, presence or not of heart failure according to the New York Heart Association (NYHA) classification.

- Paraclinical data: hemoglobin level, Antigen HBs, HVC Antibody, VHC PCR, HIV serology.

- Progression: complications, death (cause, factors associated with death).

Operational definition of terms

Assets: Refers to patients with a profession or any other income-generating activity.

Autonomy: Determines the patient's ability to walk on their own, with the support of a third party or with total incapacity.

Anemia means a hemoglobin level of less than 12 g/dL. It is considered severe if the level is less than 8 g/dL and moderate if the level is between 8 - 12 g/dL.

Classification of heart failure according to the New York Heart Association (NYHA) Stage 1: No limitation of physical activity; Stage 2: Moderate limitation of physical activity for heavy exertion; Stage 3: Marked reduction in activity with symptoms present for light activity; Stage 4: Presence of dyspnea, including at rest.

Comorbidities: This involves identifying patients who, apart from hemodialysis, had other associated pathologies such as hypertension, diabetes, viral hepatitis B or C, or HIV infection.

Social security cover: Determine whether the patient benefits from public or private medical cover to pay for medicines and other expenses apart from dialysis.

BMI, Body Mass Index (in kilograms/height in metres squared): Undernutrition <18.5; Normal 18.5 - 24; Overweight 25 - 29; Obesity > 30.

Data were collected from interviews with patients, consultation of their rec-

ords and dialysis session monitoring books. The information was recorded in a digital form from the 2RCI, which was filled in online and linked to an Excel database.

Analysis was performed using IBM SPSS version 22.0 software. Categorical variables were presented in numbers and percentages and compared using the chi-square test with Yates correction and Ficher's exact test for small numbers. Continuous variables were presented in terms of means and standard deviations, then compared using Student's t test. The significance threshold for the tests was set at 5% for a two-tailed formulation.

We obtained informed consent from patients using the written consent form of the 2RCI registry, which has been authorised by the Cote d'Ivoire national life sciences and health ethics committee, registered under number 143-19/MSHP/CNESVS-kp.

3. Results

Only patients remaining in the network of CNPTIR centers were recruited during the study period. Hemodialysis as well as anemia treatment were paid for by the Government under the direction of the CNPTIR. Patients benefited from two weekly dialysis sessions of four hours each. Treatments for cardiovascular and phosphocalcic complications were the responsibility of the patient. Dialysis dose (Kt/V) has not been assessed.

The study involved 363 chronic hemodialysis patients out of 379 included in 2018, *i.e.* 95.78% of the initial enrolment (Figure 1). The mean age was 47.3 ± 12.1 years, with extremes of 18 and 83 years. The most common age group was 45 - 54 years (31.40%) and 11.9% of patients were aged 65 and over. Males accounted for 66.4%, giving a sex ratio of 1.97. The average age at onset of dialysis was 39.43 ± 12.81 years, with extremes of 8 and 74 years.

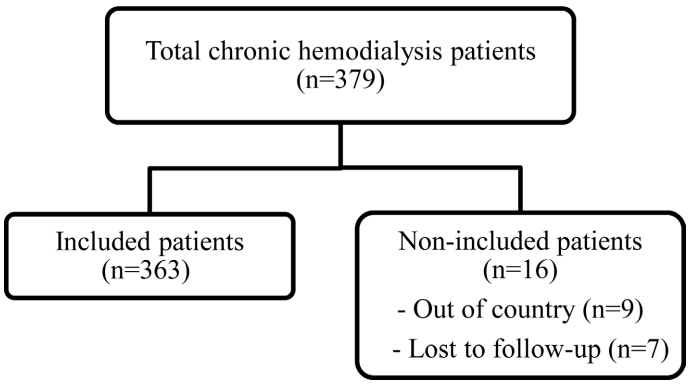


Figure 1. Flow chart of included patients.

The majority of patients were educated, with secondary education accounting for 39.4% of cases, followed by higher education in 33.8% of cases (Table 1). They worked in the informal sector in 34.7% of cases and in the public sector in 24.5%. They were unemployed in 24.5% of cases. The proportion of patients

Table 1. Sociodemographic characteristics of chronic hemodialysis patients.

Characteristics	Total (n = 363)	Male (n = 241)	Female (n = 122)	P-value	OR (IC 95%)
Age					
Mean ± standard deviation	48 ± 12.6	49 ± 11.946	46 ± 13.7	0.0012	-
<35	14.57% (54/363)	11.6% (28/241)	21.3% (26/122)	0.17	0.67 (0.37 - 1.19)
[35 - 65[	73.82% (268/363)	77.6% (187/241)	66.4% (81/122)	0.29	0.78 (0.49 - 1.25)
≥65	11.29% (41/363)	10.8% (26/241)	12.3% (15/122)	0.001	3.19 (1.52 - 6.71)
Level of education					
Illiterate	14.87% (54/363)	13.3% (32/241)	18% (22/122)	0.36	1.31 (0.73 - 2.33)
Primary	11.84% (43/363)	7.9% (19/241)	19.7% (24/122)	0.49	0.8 (0.42 - 1.53)
Secondary	39.39% (143/363)	39% (94/241)	40.2% (49/122)	0.22	1.3 (0.85 - 1.98)
Hygher	33.88% (123/363)	39.8% (96/241)	22.1% (27/122)	0.14	0.72 (0.46 - 1.12)
Marital status					
Single	34.98% (127/363)	29.5% (71/241)	45.9% (56/122)	0.02	0.6 (0.38 - 0.93)
Married/partnered	60.05% (218/363)	67.2% (162/241)	45.9% (56/122)	0.01	1.7 (1.11 - 2.62)
Separated/divorced	1.65% (6/363)	1.2% (3/241)	2.5% (3/122)	0.77	1.26 (0.25 - 6.33)
widowed	3.30% (12/363)	2.1% (5/241)	5.7% (7/122)	0.43	0.62 (0.18 - 2.09)
Profession					
Unemployed	24.51% (89/363)	19.5% (47/241)	34.4% (42/122)	0.53	1.16 (0.72 - 1.88)
Civil servant	24.51% (89/363)	26.1% (63/241)	21.3% (26/122)	0.53	1.16 (0.72 - 1.88)
Private sector employee	14.04% (51/363)	14.1% (34/241)	13.9% (17/122)	0.10	1.64 (0.9 - 2.97)
Informal sector	34.71% (126/363)	38.2% (92/241)	27.9% (34/122)	0.01	0.58 (0.37 - 0.9)
Pupil/student	1.10% (4/363)	0.8% (2/241)	1.6% (2/122)	0.13	-
Religious	1.10% (4/363)	1.2% (3/241)	0.8% (1/122)	0.04	-
Social security cover					
None	70.24% (255/363)	68.5% (165/241)	73.8% (90/122)	0.36	1.23 (0.78 - 1.95)
Private	4.95% (18/363)	6.6% (16/241)	1.6% (2/122)	0.14	2.04 (0.77 - 5.4)
Public	15.70% (57/363)	14.9% (36/241)	17.2% (21/122)	0.21	0.69 (0.39 - 1.24)
Double	9.09% (33/363)	10% (24/241)	7.4% (9/122)	0.33	0.69 (0.33 - 1.46)
Time on dialysis					
≤5	44.35% (161/363)	46.1% (111/241)	41% (50/122)	0.36	1.22 (0.79 - 1.87)
6 - 10	42.97% (156/363)	40.2% (97/241)	48.4% (59/122)	0.19	0.76 (0.5 - 1.15)
≥11	12.67% (46/363)	13.7% (33/241)	10.7% (13/122)	0.54	1.2 (0.67 - 2.14)
Comorbidities					
Hypertension	95.6% (347/363)	95% (229/241)	96.7% (118/122)	0.46	-
Diabetes	7.8% (27/363)	9.1% (22/241)	3.3% (4/122)	0.54	1.28 (0.57 - 2.84)

Continued

HIV	4.6% (9/211)	2.2% (3/121)	6.6% (6/90)	0.11	3.6 (0.68 - 18.68)
Hepatitis B	3.8% (8/209)	3.7% (5/135)	4.05% (3/74)	0.6	1.81 (0.21 - 15.70)
Hepatitis C	1.4% (3/209)	2.2% (3/135)	0% (0/74)	0.62	-
Obesity/overweight	7.9% (29/363)	8.3% (20/241)	7.4% (9/122)	0.0001	0.13 (0,04 - 0.43)
Anemia	68.04% (66/97)	87.2 % (41/69)	89.3 % (25/28)	0.35	-
Stroke	8.6%% (18/209)	7.8% (15/192)	15.7% (3/17)	0.17	2.53 (0.65 - 9.79)

working in the informal sector was statistically higher in the men's group than in the women's group (p = 0.01) (Table 1).

Our patients were married or in a couple in 60.1%, single in 34.9% and widowed in 3.3%. In the men's group, the proportion of single patients was statistically lower (p = 0.02) and conversely, the proportion of married or partnered patients was higher (p = 0.01) than in the women's group (Table 1). Patients were covered by private or public insurance, or both, and those with no social cover accounted for 70.2% of cases.

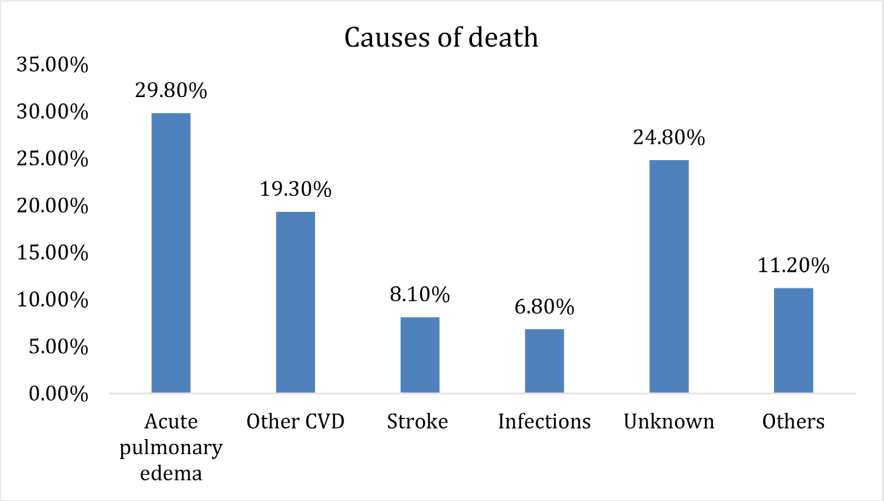
The average length of time patients had been on dialysis was 6.94 ± 4.1 years, with extremes of 2 and 28 years. This duration was less than 5 years in 44.3% of cases, between 6 and 10 years in 42.9% and more than 10 years in 12.6% of cases. (Table 1).

The comorbidities found were hypertension in 95.6% of cases, diabetes in 7.8% and HIV in 4.6%. Anemia was found in 68% of cases and stroke in 8.6%. Other co-morbidities were heart failure (83.2%) and overweight or obesity in 7.9% of cases.

During the study period, 161 patients died, representing a mortality rate of 44.35%. Acute pulmonary edema (29.8%), stroke (6.8%) and other cardiovascular diseases (19.3%) were the main causes of death. In addition, 7.8% of patients died at home (Figure 2).

In univariate analysis, the mean age was higher in the deceased group (p = 0.001) and the proportion of patients aged over 65 years was statistically higher in the deceased group than in the non-deceased group (HR = 3.19; CI95% = 1.52 - 6.71; p = 0.001). In addition, the proportion of patients who were married/coupled was higher in the deceased group compared with the non-deceased group (HR = 1.7; CI95% = 1.11 - 2.62; p = 0.0147). On the other hand, the proportion of patients who were overweight or obese (p = 0.01) or working in the informal sector (0.0001) was statistically lower in the deceased group than in the non-deceased group (Table 2). There was no significant difference in the survival curves for men and women (P > 0.05) (Figure 3).

In multivariate analysis, factors such as age ≥ 65 years (HR = 3.66; CI 95% = 1.55 - 8.67; p = 0.003), "married/coupled" status (HR = 2.02; CI 95% = 1.24 - 3.31; p = 0.005) and normal weight at the start of dialysis (HR = 9.59, CI95% = 4.19 - 21.95; p = 0.001) were associated with the risk of death (Table 2).



CVD = Cardiovascular Diseases.

Figure 2. Causes of death.

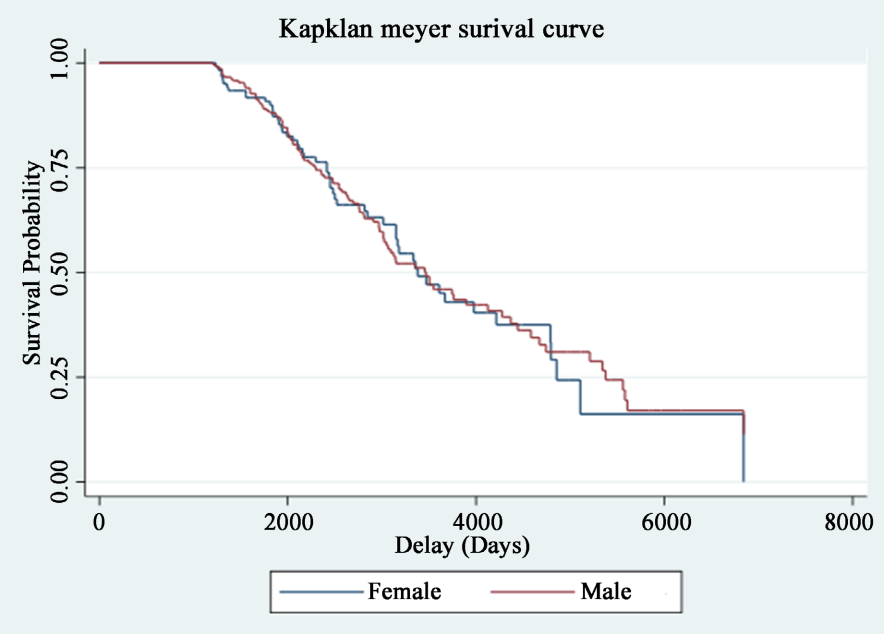


Figure 3. Survival curve by gender ($P = 0.8325$).

Table 2. Risk factors for death in univariate and multivariate analysis including only variables significant at 20%.

Characteristics	n	Death (%)	Univariate analysis unadjusted HR	*P-value*	Multivariate model adjusted HR (CI 95%)	*p-value*
Gender						
Female	53	32.9%	0.95	0.80		
Male	108	67.1%				
Age						
<35	21	13%	0.67	0.17		
[35 - 65[	115	71.4%	0.78	0.29		

Continued

≥65	25	15.5%	3.19	0.001	3.66 (1.55 - 8.67)	0.003
Education level						
Illiterate	27	16.8%	1.31	0.36		
Primary	17	10.6%	0.8	0.49		
Secondary	69	42.9%	1.3	0.22		
Higher	48	29.8%	0.72	0.14	0.91 (0.51 - 1.62)	0.75
Marital status						
Single	46	28.6%	0.6	0.02		
Married/ partnered	108	67.1%	1.7	0.01	1.88 (1.14 - 3.08)	0.01
Separated/divorced	3	1.9%	1.26	0.77	1.85 (0.32 - 10.66)	0.48
Widowed	4	2.5%	0.62	0.43	058 (0.14 - 2.39	0.45
Profession						
Unemployed	42	26.1%	1.16	0.53		
Civil servant	42	26.1%	1.16	0.53		
Private sector employee	28	17.4%	1.64	0.10		
Informal sector	45	28%	0.58	0.01	0.58 (0.35 - 0.97)	0.03
Pupil/student	0	0%	-	0.13		
Religious	4	2.5%	-	0.04		
Social security cover						
None	117	72.7%	1.23	0.36		
Private	11	6.8%	2.04	0.14	1.94 (0.63 - 5.97)	0.24
Public	21	13%	0.69	0.21		
Double	12	7.5%	0.69	0.33		
Duration (years) on dialysis						
≤5	64	39.8%	1.22	0.36		
6 - 10	71	44.1%	0.76	0.19	0.82 (0.52 - 1.31)	0.41
≥11	26	16.1%	1.2	0.54		
Comorbidities						
Hypertension	145	90.1%	1.28	$1.45.10^{-6}$		
Diabetes	13	8.1%	2.53	0.54		
Stroke	3	17.7%	3.6	0.17		
HIV	2	11.8%	1.81	0.11	0.62 (0.10 - 3.92)	0.60
Hepatitis B	1	6.3%	-	0.6		
Hepatitis C	0	0%	-	0.62		
Obesity or overweight	3	1.9%	0.13	0.0001		
Normal weight at inclusion	153	95%	9.07	0.05	13.28 (3.69 - 47.77)	0.0001
Anemia	6	100 %	1.22	0.35		

4. Discussion

The data from the pilot study conducted for the implementation of the 2RCI Registry formed the basis of the present work. The mean age of our patients was 47.3 ± 12.1 years, with extremes of 18 and 83 years. In 2018, TCHUENDEM found with the same cohort, a mean age of 44.44 ± 12.35 years with extremes of 16 and 87 years [4]. These figures are not very far from those published by TSEVI in Togo, 49.7 ± 13.5 years [5] and FAYE in Senegal 50.49 ± 14.50 years [6], in West Africa. FOUDA in Cameroon found 47.97 ± 13.19 years, in Central Africa [7]. The average age for dialysis cannot be analyzed without taking into account the life expectancy of the general population. According to the UNDP Human Development Report 2020, life expectancy in Côte d'Ivoire in 2020 is estimated at 57 years [8]. The population of dialysis patients in Africa is no different. They are just as young as the general population. And yet, according to sociologists, young people are the section of the population that does not often feel involved in screening for so-called chronic diseases [9], which have long been attributed to the elderly.

Conversely, the average age for dialysis is advanced in developed countries such as France, according to the 2018 Renal registry report [10]. This can be explained by sustained public awareness and the development of technical facilities.

Most (66.4%) of our patients were men. This observation of the masculinisation of renal failure is made by all published studies, with a sex ratio of 1.5 according to TSEVI [5], 1.2 according to FOUDA in Yaoundé [7] and 1.46 according to Ramilitiana in Madagascar [11]. The predominance of men in renal failure may be explained by the fact that the male gender is a recognised cardiovascular risk factor. Cardiovascular diseases are known to cause renal failure.

The age at onset of dialysis was 39.43 ± 12.81 years, with extremes of 8 and 74 years. This observation is identical to that of all the African series. Ramilitiana and Sabi found an average of 45.44 [11] and 34.5 years [12] respectively. Mohammed Asserraji in Morocco also found 49.92 [13]. The young age at which dialysis is started in Africa is primarily due to the lack of awareness and effective screening of all age groups, and the late referral of patients to the doctor. Most patients are seen immediately at the dialysis stage.

The mean duration of dialysis for our patients was 6.94 ± 4.1 years, with extremes ranging from 2 to 28 years. Sabi *et al.* report 5.5 years [12] and Faye in Senegal reports 51.97 months or 4.33 years [6]. These figures are not far from our findings. Fouda found a lower average estimated at 12 months [7]. The average duration of fewer than 10 years can be explained firstly by the fact that our patients dialyse for 8 hours a week instead of the recommended 12 hours. In addition, our centres, like those in other African countries, are plagued by shortages of consumables or technical problems that hamper the provision of care.

The majority of patients attended school, with secondary school the most represented, with 143 patients (39.4% of cases). Tsevi reported a percentage of 53.2% [5] of patients with secondary education, which is close to our result. The

secondary level of our patients makes it easy to convey information that encourages their participation in care.

Married patients were the most represented with 218 patients, *i.e.* 60.1% of cases. Sabi *et al.* reported a similar figure of 74% [12]. The presence of a spouse in our patients enables them to bear the emotional burden of dialysis. Spouses are a support for patients. If they separate, the patient's condition deteriorates.

The unemployed and shopkeepers were the most represented, with 21.2% and 14.9% of cases respectively. TSEVI found that the unemployed and shopkeepers were the most numerous in its cohort, with 20% and 21.2% respectively [5]. Kidney failure is a reason for redundancy for some patients. And yet the disease is very precarious. Having exhausted all the support they can get from family and friends, some patients try to find an income-generating activity, such as a rudimentary business to cover the costs of their supplementary drugs. This could explain the high proportion of informal workers.

Patients with no social security coverage represented 70.2% of cases, five points less than the 75.8% reported by Tchuendem in 2018 [4]. Much less than the 96% announced by Sabi *et al. [12]*.

The Government has implemented universal health coverage which, for the moment, does not take into account the costs generated by chronic illnesses such as kidney failure. This is why patients do not find it interesting to subscribe to this national health insurance.

The Cocody dialysis centre received the most patients, 59% of patients. An observation remains identical to that made by Tchuendemen 2018, 59.2% of patients [4]. The Cocody centre is the main centre of the network of social hemodialysis centers scattered across the country. As such it offers greater reception capacity.

Patients without social security coverage represented 93% of the inactive and 63% of the active. In 2018, TCHUENDEM found respectively for the same classes of activity, 89.39% and 60% [4]. We see that after three years, 3% of patients have lost their social security coverage.

OUDA and TSEVI report the finding, 91% of patients do not have social security coverage [5] [7].

In Côte d'Ivoire, private insurance only covers patients for a specific period of time. Given the chronic nature of dialysis, some insurance companies prefer to terminate the contract with patients after a given period. Especially if the person is no longer solvent or in activity, as is the case with several of our patients. Available universal public social coverage does not yet cover certain costs related to dialysis.

However, although this is still insufficient, considerable efforts have been made by the government through the CNPTIR by the creation of new public hemodialysis centers. From six public hemodialysis centers in 2018, the country currently has 12 centers across the country.

High blood pressure was present in 347 of our patients, *i.e.* 95.6% of cases.

Cissé Moustapha found a lower prevalence, at 71% [14]. Benja Ramilitiana reported even less, at 59.83% [11]. Subdialysis may explain the presence of a high percentage of hypertension.

After three years of follow-up, 202 patients were alive and 161 had died. FOUDA reported a death rate of 58% after 15 months of follow-up [7]. Jean-Philippe Jais reported a stable mortality rate in dialysis between 2008 and 2020 of 16 per 100 patient years in France [15]. This difference can be explained by the level of implementation and management of hemodialysis techniques. The first reason that could explain this high mortality in our context is the insufficient quantity and quality of dialysis. In fact, the demand for dialysis is higher than supply, so that in order to care for the maximum number of patients, the solution found is to reduce the time. The vast majority of patients receive two four-hour sessions a week. Another reason could be the high frequency of cardiovascular complications among our patients.

Older age and married or partnered status were associated with the risk of death in our patients. Fouda found no significant association between patient age and the occurrence of death [7]. Age over 65 years is correlated with a longer history of dialysis and the development of complications associated with chronic dialysis.

In the literature, we did not find any link between married/couple status and death in chronic dialysis patients. However, Ambar Khaira reported a prevalence of depression of 57.4% in married dialysis patients, 36.7% of which was due to marital stress [16]. We believe that our result can be explained by psychosocial stress. Chronic diseases such as renal failure give rise to various problems for married patients or those in a couple. Firstly, the loss of social status as head of the family, sometimes linked to the loss of employment or complications of the disease, which make the patient socially fragile, and finally the loss of status as husband. These reasons could be the cause of stress, leading to hypertension that is resistant to antihypertensive drugs. This situation could lead to heart failure, which would explain the acute pulmonary edema that is a frequent cause of death in the context of sub-dialysis.

Normal weight at the start of dialysis was also associated with the risk of death. Deficiencies in the quality and quantity of dialysis expose patients to undernutrition. Jean-Philippe reported that cachexia was the cause of death for 9% of patients [15].

5. Limitations of Our Study

The limitation of our study is that it does not fully evaluate hemodialysis patients. Monthly, quarterly and annual health check-ups are not done, due to the unavailability of certain blood tests in dialysis centers. This could have highlighted certain morbidity-mortality relations. Although some exams are covered by the government, the majority of follow-up examinations are at the patients' expense. This constitutes an obstacle to their achievement.

6. Conclusions

In Côte d'Ivoire, chronic hemodialysis concerns young patients, predominantly men, who have been on dialysis for an average of seven years, two out of three of whom have no social security cover.

After three years of follow-up, the rate of death on dialysis was 44.35%. Patients frequently die of acute pulmonary edema. The factors associated with death were age over 65, married or partnered status and normal weight at the start of dialysis.

According to these results, survival and quality of life on dialysis remain key issues. Hence the importance of pursuing the policy of decentralising public centres and optimising access to dialysis in terms of quality and quantity in order to improve patient survival.

Declarations

Ethics Approval and Consent to Participate

This study was authorized by the National Committee of Life Sciences Ethic and Health in Côte d'Ivoire, registered under number 143-19/MSHP/CNESVS-kp.

The committee attested to the ethical nature of the study and gave consent to its conduct.

All the experiments carried out during our study and the information collected were done in strict compliance with current guidelines of the National Committee of Life Sciences Ethic and Health in Côte d'Ivoire, and international regulations (Declaration of Helsinki).

Participation in this study was entirely free and voluntary. Participants were free to accept or refuse to participate in our study. Those who accepted were also free, at any time, to end their participation, and, on simple verbal notice without giving an explanation.

Informed Consent Was Obtained from All Subjects

The study was conducted in compliance with ethics and medical deontology, human dignity.

The participants were submitted to a confidential questionnaire, and in order to preserve their anonymity a unique number was assigned to them.

Participation in the study was not subject to financial compensation for the participants.

Availability of Data and Materials

The kidney department of the teaching hospital of Treichville will keep the study's physical data including the interviews' recordings. For the duration of the study, the information concerning the study has been stored in a restricted and closed room.

The data for this study are available upon request to Pr. YAO KOUAME

HUBERT or to Dr MOUDACHIROU MOHAMED whose contact details are available in the chapter relating to the contact details of the authors.

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Authors' Contributions

KANGANGA Arthur conducted the study. DIOPOH Patrick finalised the analysis of the data and the writing of the article, and translated it. KONAN Serge Didier, OUATTARA Kolo Claude, KOUADIO Marie-Dominique and MOUDACHIROU Mohamed were involved in patient follow-up and reading the article. YAO K. Hubert coordinated the study and publication of this article. All the authors contributed to the drafting and proofreading of this work.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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