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# Epidemiological Profile of Chronic Hemodialysis Patients in a Semi-Urban City in Ivory Coast

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## Abstract

**Background:** Chronic kidney disease is a global public health problem in terms of prevalence, the cost of management and its mortality. Despite the high cost of hemodialysis facilities, many public units are being created to meet the ever-increasing demand of kidney disease patients in Ivory Coast. The aim of our study was to describe the epidemiological profile of patients treated by chronic hemodialysis in a public unit in an Ivorian city.

**Methods:** It was a retrospective study of record of chronic hemodialysis patients for at least 3 months during the period from November 2014 to December 2020.

**Results:** The mean age was 41.5 years with a sex ratio of 1.5. The dialysis started as an emergency with 85.9% of patients, on a temporary catheter in 78.4%. The average duration on dialysis was 28.08 months. Mortality rate was 26.67%. Factors associated with death were a non-higher level of education (0.01), chronic heart failure (0.001), the presence of a temporary catheter (0.05), uncontrolled blood pressure (0.0001), a severe anemia (0.0001), the absence of the use of erythropoietin (0.004), the absence of diuretic (0.02) and a less than one year duration on dialysis (0.00012).

**Conclusion:** The patients treated in this dialysis unit were young. Mortality was high. We recommend the inclusion of dialysis care for chronic kidney disease patients in the universal healthcare coverage of Ivory Coast.

**Keywords:** Chronic kidney disease • Hemodialysis

## Introduction

Chronic kidney disease (CKD) is a chronic non-communicable disease with increasing incidence and prevalence worldwide. It is associated with the risk of cardiovascular disease, progression to end-stage renal disease (ESRD) and high mortality. It requires management by renal replacement therapies (hemodialysis, peritoneal dialysis or transplantation). Progress and efforts have been made over the last ten years in terms of access to care, but ESRD presents a real challenge to the health system due to the cumbersome logistics, the required human resources and the significant and mandatory financial resources for its management. In 2012, CKD was considered the most expensive chronic disease in the United States, representing 5% of the global health budget for less than 1% of the population [1]. In developing countries, particularly in sub-Saharan Africa, mortality related to CKD is high due to insufficient material, financial and human resources [2]. Ivory Coast has decided to take several measures and actions to meet this demand: increase in the supply of dialysis, development of renal transplantation, implementation of information systems and a screening and prevention program. Many dialysis centers were then created in the country with a progressive extension increasing to 8, the number of public dialysis centers throughout the country.

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We undertook this work with the aim of assessing the situation in the first public dialysis center created outside Abidjan. Our objective was to study the epidemiology of patients treated by chronic hemodialysis in a public center located in an African city outside the capital.

## Methods

Our study took place in the only public dialysis center in Bouaké. It is a city in central Ivory Coast, located about 300 km from Abidjan, the economic capital of Côte d'Ivoire. With a population of approximately 1.5 million persons, it is the second most populous city of the country. The city has hosted the first dialysis center outside of Abidjan since 2014. The missions of the dialysis center in this city are: screening for kidney disease, diagnosis and management of kidney pathologies. The main activity of that center is the treatment of kidney patients by hemodialysis. The staff is composed of a nephrologist, 7 nurses and 9 care assistants. The staff has a short training in dialysis. The center has a capacity of 10 generators. The dialysis prescription is 2 sessions of 4 hours per week. The blood flow varies from 250 to 300 cc per minute. The sessions are performed on Gambro AK 200 machines with polysulfone membranes of the "low flux" type with a standard body surface area of 1.50 $m^2$. The study involved subjects treated with chronic iterative hemodialysis from November 2014 until December 2020, i.e., a period of 6 years. We included any patient who received hemodialysis sessions over at least 3 months for chronic renal failure during the study period. We did not include any patient who had received dialysis for acute renal failure and any chronic dialysis patient temporarily treated in the center. Our work was retrospective, and the sampling was exhaustive, taking into account all the patient records whose names were mentioned in the dialysis register. For each patient included, the following data were collected using a standardized survey form: sociodemographic data (age at the time of the study, sex, marital status, residence of the patient, level of education), clinical data (history; comorbidities: diabetes, hypertension, smoking, pericarditis, tuberculosis, coronary insufficiency, walking independence; end-dialysis

weight, height, blood pressure, and interdialytic weight gain), paraclinical data (hemoglobin level less than three months old), dialysis modality (emergency or scheduled), route after three months of dialysis, cumulative number of dialysis sessions, and duration on dialysis. For our study, the operational definitions were: we considered as deceased any patient declared dead in the registry; those for whom there was no information were considered as alive. The data collected from the dialysis registry, patient records, dialysis session logbooks, and using a standardized survey form were entered into an Excel database. The analysis was done using SPSS software version 22.0. The variable of interest was the occurrence of death. The distribution of quantitative variables is described by means and standard deviations, medians and extremes. On the other hand, the qualitative parameters are described in terms of numbers and percentages. The statistical test used was the chi-square test with Yates correction and Ficher's exact test for small numbers. The significance level of the tests was set at 5% ($p \leq 0.05$).

## Results

During the study period, we collected 430 records of chronic hemodialysis patients, of which 255 records were usable, which constituted our study population. The mean age of our patients at the time of the survey was 41.50 ± 15.53 years with extremes ranging from 12 to 87 years. The mean age of entry into dialysis was 39.22 ± 10.78 years with extremes from 12 to 84 years. Patients in the age group 35 to 44 years represented 33.87% of the population. The patients were predominantly male with a sex ratio of 1.50. Hemodialysis patients were not educated in 53.99% of cases and in 60.21% were single. Patients did not reside in the city where the center is in 44.9% of cases (Table 1). The comorbidities reported by our patients were diabetes in 4.3% of cases, hypertension in 52.94% of cases and HIV in 2.75% of cases (Table 2). 40.8% of the patients had hypertensive nephropathy and 30.7% had glomerular nephropathy. Nephropathy was classified as undetermined in 22.84%. Chronic renal failure was tubulointerstitial in 5.66%. In our study 19.2% of the patients were still using traditional drugs. Regarding the history of dialysis, patients had started dialysis on a temporary biluminal catheter as an approach in 78.4% of cases. Most chronic hemodialysis patients (55.29%) had uncontrolled blood pressure. Anemia was present in 90.6% of cases and was severe in 32% of cases. The average hemoglobin level was 7.95 +/-1.98 with extremes of 3 to 12.8 g/dl. Drug management consisted of erythropoietin administration in 33%. Some chronic hemodialysis patients received blood transfusion in 32.16% of cases at least once during their replacement therapy. For hypertension, two drugs were prescribed in 48.19% of cases. Those with residual urine output received loop diuretics in 6.08% of cases. Hypocalcemia was corrected with oral calcium in 9.02% of cases. Between two sessions, interdialytic weight gain of more than 2 kg was found in 46.12% of cases (Table 3). The average duration of dialysis was 28.08 months with extremes of 4 months and 6 years. Patients who had been on dialysis for 3 to 5 years represented 34.12%. The mortality rate was 26.67%. Factors associated with death were a non-higher level of education, chronic heart failure, the presence of a temporary catheter, uncontrolled blood pressure, severe anemia, absence of erythropoietin use, absence of diuretic and less than one year on dialysis. The survival curve shows that the probability of survival in this population decreases with time (Figure 1).

## Discussion

Despite progress in Nephrology and good medical education of patients with chronic kidney disease, there are still difficulties in approaching a patient with end-stage chronic kidney disease. We conducted this retrospective study on the epidemiological profile of patients treated in a dialysis center located in a semi-urban area with a limited income population. Most of our patients

**Table 1.** Demographic characteristics of chronic hemodialysis patients in an African city from 2014 to 2020.

| Parameters | | Deaths | Survivors | Total | p |
|---|---|---|---|---|---|
| Mean age ± Standard Deviation (years) | | 43.77 ± 18.3 | 40.66 ± 12.88 | 41.50 ± 15.53 | 0.25 |
| Gender | Female | 42.65%(29/68) | 39.04%(73/187) | 40% (102/255) | 0.66 |
| | Male | 57.35%(29/68) | 60.94%(114/187) | 60% (143/255) | 0.66 |
| Education | No | 55.56%(38/68) | 39.58% (74/187) | 43.91% (112/255) | 0.13 |
| | Primary | 14.81% (10/68) | 17.71%(33/187) | 16.86% (43/255) | 0.72 |
| | Secondary | 29.63%(20/68) | 23.96%(45/187) | 25.51% (65/255) | 0.54 |
| | Higher | 0%(0/68) | 18.75%(35/187) | 13.72% (35/255) | 0.01 |
| Marital status | Single | 61.54%(41/68) | 60.82%(114/187) | 60.2% (155/255) | 0.94 |
| | Married | 0%(0/68) | 2.06%(3/187) | 1% (3/255) | 0.46 |
| | Divorced | 38.46%(27/68) | 37/11%(70/187) | 38.7% (97/255) | 0.89 |
| Area of residence | City concerned | 72.97%(49/68) | 86.61%(161/187) | 55.1% (210/255) | 0.05 |
| | Out of town | 27.03%(19/68) | 13,39%(26/112) | 44.9% (45/255) | 0.05 |

**Table 2.** Cardiovascular risk factors and infectious comorbidities of chronic hemodialysis patients in an African city from 2014 to 2020.

| Parameters | | Deaths | Survivors | Total | p |
|---|---|---|---|---|---|
| Smoking | Yes | 0%(0/68) | 0.53%(01/187) | 0.3% (1/255) | 0.54 |
| | No | 100%(68/68) | 99.47%(186/187) | 99.67% (254/255) | |
| Diabetes | Yes | 4.41%(3/68) | 4.28%(08/187) | 4.89% (11/255) | 0.96 |
| | No | 95.59%(65/68) | 95.72%(179/187) | 95.11% (244/255) | |
| HBP | Yes | 42.65%(29/68) | 48.66%(91/187) | 47.05% (120/255) | 0.39 |
| | No | 57.35%(39/68) | 51.34%(96/187) | 52.95% (135/255) | |
| HIV | Yes | 4.41%(3/68) | 2.14%(04/187) | 2.75% (7/255) | 0.32 |
| | No | 95.59%(65/68) | 97.86%(183/187) | 97.25% (248/255) | |
| Tuberculosis | Yes | 0%(0/68) | 1.60%(03/187) | 1.17% (3/255) | 0.29 |
| | No | 100%(68/68) | 98.40%(184/187) | 98.83% (252/255) | |
| CHF | Yes | 95.59%(65/68) | 6.95%(13/187) | 30.59% (78/255) | 0.001 |
| | No | 4.41%(3/68) | 93.05%(174/187) | 69.41% (177/255) | |
| Disability | Yes | 0%(0/68) | 1.6%(03/187) | 1.17% (3/255) | 0.29 |
| | No | 100%(68/68) | 98.40%(184/187) | 98.83% (252/255) | |

HBP: High Blood Pressure; HIV: Human immuNodeficiency Virus; CHF: Chronic Heart Failure

**Table 3.** Dialysis parameters of chronic hemodialysis patients in an African city from 2014 to 2020.

| Parameters | Deaths | Survivors | Total | p |
|---|---|---|---|---|
| Scheduled dialysis | 83.82%(57/68) | 86.63%(162/187) | 85.88 (219/255) | 0.56 |
| Emergency dialysis | 16.18%(11/68) | 13.37%(25/187) | 14.12 (36/255) | |
| AVF | 13.24%(9/68) | 24.6%(46/187) | 21.56 (55/255) | 0.05 |
| Catheter Temporary | 86.79%(59/68) | 75.40%(141/187) | 78.44 (200/255) | |
| 1session/week | 9.68%(7/68) | 6.86%(27/187) | 13.33 (34/255) | 0.3 |
| 2 sessions/week | 90.32%(61/68) | 93.14%(174/187) | 86.67 (221/255) | |
| BP uncontrolled | 44.78%(30/68) | 97.85%(84/187) | 44.70 (114/255) | 0.0001 |
| BP controlled | 55.22%(38/68) | 2.15%(103/187) | 55.30 (141/255) | |
| Mean weight ± SD (Kg) | 57.76 ± 11,75 | 59.29 ± 11,86 | 58.87 ± 11,80 | 0.36 |
| ID Weight <2Kg | 55.22%(37/67) | 42.70% (76/178) | 46.13 (113/245) | 0.07 |
| ID Weight >3Kg | 7.46%(5/67) | 8.43% (15/178) | 8.16 (20/245) | 0.8 |
| ID Weight 2-3Kg | 37.31%(25/67) | 48.88% (87/178) | 45.71 (112/45) | 0.1 |
| Mean Hb ± SD (g/dl)) | 7.55 ± 1.97 | 8.08 ± 1.96 | 7.95 +/-1,98 | 0.02 |
| Severe anemia | 55.9% (38/68) | 23% (43/167) | 34.46 % (81/235) | <0.0001 |
| Moderate anemia | 44.1% (30/68) | 77% (144/167) | 65.54% (171/235) | |
| (a) Sessions ≤ 25 | 59.7% (40/68) | 36.7% (69/187) | 48.45% (109/255) | 0.0018 |
| Sessions > 25 | 40.3% (28/68) | 63.3% (118/187) | 51.55% (146/255) | |
| (b) ≤ 12 months | 59.7% (32/68) | 35.2% (28/187) | 23.53 (60/255) | 0.0000012 |
| > 12 months | 40.3% (36/68) | 64.8% (159/187) | 76.47(195/255) | |

AVF: Arteriovenous Fistula; KT: Dialysis Catheter; sessions per week: frequency of sessions per week; BP: Blood Pressure; ID weight: Interdialytic Weight; Hb: Hemoglobin; (a): cumulative number of sessions; (b): average time on dialysis, SD standard deviation

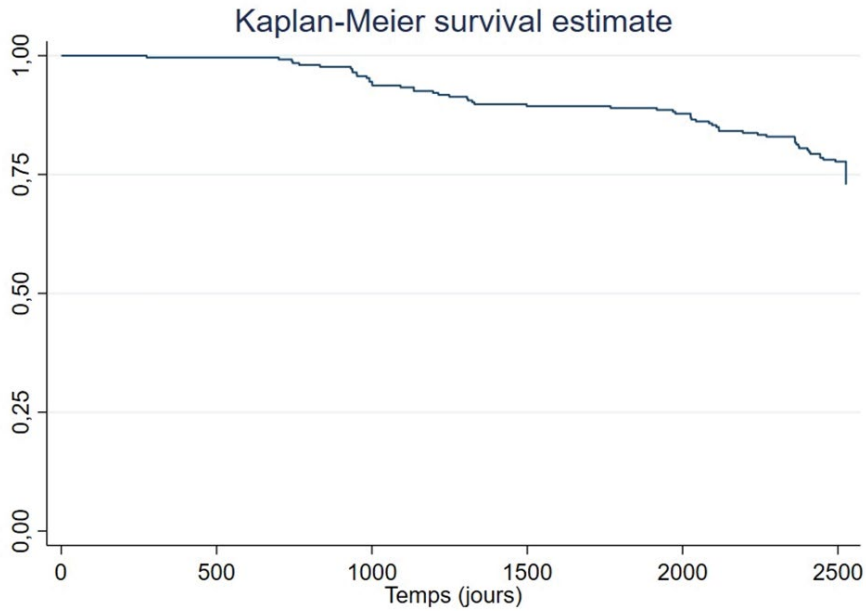


**Figure 1.** Kaplan-Meier survival curve.

were young adults, the average age was 41.50 ± 15.53 years. Similar results have been reported by Yaya in Senegal who found mean age of 41 years [3]. In Japan, the mean age of patients was 70.6 ± 13.4years [4]. This disparity is probably due to the aging of the population and the improvement of the level of medical care in developed countries. The gender distribution in our series was characterized by a male predominance with a sex ratio of 0.64. This result is consistent with that of Yaya who observed a sex ratio of 0.85 with more men [3]. This gender inequality is due to the frequency of kidney disease in men and their more rapid progression towards CKD. Women seem to be more protected against CKD than men. This difference could be due to endogenous estrogens which have a protective effect, to a more favorable renal hemodynamics, and a better renewal capacity of tubular cells [5]. In our context, HBP (47%), heart failure (30.59%) and diabetes (4.8%) were the most represented cardiovascular risk factors. Unlike Ramilitiana et al who found High Blood Pressure and smoking as the two main factors with respectively 59.83% and 38.49% [6]. In our study HIV status was known in 2.75% of cases. Fouda et al, found HIV 7.1% of cases [7]. This low rate was because serology was not performed and was at the expense of the patients. Tuberculosis was found in 1.17% of our patients. Fouda in Cameroon found 8% of tuberculosis cases [7]. The incidence of tuberculosis is increased with these patients due to the alteration of the immune system linked to chronic kidney disease and worsened by dialysis. At initiation of dialysis, 78% patients had a catheter. Our findings are lower than those of Yaya et al. who found in 96.6% of patients with a catheter [3]. The use of temporary central catheters can be explained by the fact that most patients were put on dialysis under emergency conditions and could not obtain permanent catheters. The temporary catheter remains the emergency route with a patient without AVF.

High Blood Pressure (HBP) is common with chronic kidney disease patients treated with dialysis and we reported an incidence of uncontrolled blood pressure with 44% of our patients. Higher proportions of uncontrolled blood pressure have been reported by other authors: 63.1% in Morocco and 71% in Senegal [8,9]. These differences in proportions are related to the measurement methods used by the authors. We considered blood pressure

**Table 4.** Treatment provided to chronic hemodialysis patients in an African city from 2014 to 2020.

| Parameters | | Deaths | Survivors | Total | p |
|---|---|---|---|---|---|
| EPO | Yes | 19.12%(13/68) | 37.97%(71/187) | 32.94% (84/255) | 0.004 |
| | No | 80.88%(55/68) | 62.03%(116/187) | 67.06% (171/255) | |
| Transfusion | Yes | 29.85%(20/68) | 32.80%(61/187) | 31.76% (81/255) | 0.65 |
| | No | 70.15%(48/68) | 67.20%(126/187) | 68.24% (174/255) | |
| Diuretic | Yes | 12.31%(8/65) | 26.28%(36/137) | 21.78% (44/202) | 0.02 |
| | No | 87.69%(57/65) | 73.72%(101/137) | 78.22% (158/202) | |
| Calcium | Yes | 12.31%(6/63) | 26.28%(17/137) | 11.5% (23/200) | 0.55 |
| | No | 87.69%(57/63) | 73.72%(120/137) | 88.5% (177/200) | |

EPO: Erythropoietin; Anti HBP: Anti-Hypertensive Treatment

measurements in the dialysis room and the other authors outside the treatment room. Compared to measurements made around the dialysis session, studies have showed a better prediction of morbidity and all-cause mortality with the results of BP measurements made outside the dialysis unit [10-12] and even the existence of a linear relationship between systolic pressure measured outside the dialysis center and all-cause mortality [13]. The "white coat" effect and "masked hypertension" (30% and 7% with renal failure patients, respectively), are probably more common with dialysis patients [14-16]. The 2017 consensus on high blood pressure with dialysis patient recommends the use of self-measurement of blood pressure (SMBP) or ambulatory blood pressure measurement (ABPM) to better define the blood pressure level, to specify the prevalence of high blood pressure, the cardiovascular and global prognosis, and the targets for treatment of high blood pressure with these patients [17]. Though, dialysis is a treatment which reduces the consequences of uremia, mortality of chronic hemodialysis patients remains high. We have a mortality of 26%. In Cameroon, Halle et al noted a mortality of 34% [18]. There are differences in mortality rates in different countries and geographical regions which can be explained by differences between patients and the dialysis itself. With regard to comorbidities, these may include increased incidence of diabetes, psychiatric and cardiovascular diseases, advanced age of the patient; racial or genetic differences [19]. In our study, the factors associated with death were non-higher educational level (0.01), chronic heart failure (0.001), presence of a temporary catheter (0.05), unbalanced blood pressure (0.0001), severe anemia (0.0001), no erythropoietin therapy (0.004), no diuretic use (0.02), and less than 1 year on dialysis (0.00012). Heart diseases are also very common within the dialysis population. In addition to prior coronary artery disease, additional factors common with dialysis patients may lead to the development of coronary artery disease and increased cardiovascular mortality (Table 4).

Our study shows limits because the information sought from the patients' clinical records was sometimes incomplete. Several para-clinical data were missing, this being explained on the one hand by the low purchasing power of our patients, who were themselves responsible for the costs of complementary examinations not covered by the healthcare institution.

## Conclusion

The capacity of hemodialysis care in Ivory Coast has increased in recent years. Indeed, the policy of decentralization of hemodialysis services has allowed the opening of hemodialysis centers in the interior of the country, including the one that was the subject of our study. Our patients were mostly young adults with an average age of 41 years. Dialysis was initiated in our center in 85.9% of cases. The first session at the center was performed on a catheter in 81% of cases. Anemia was found in 90.6% of cases and its management by ESA was possible in 32.9%. Mortality was 26%. The more chronic kidney disease worsens, the more it requires continuous and simultaneous monitoring of various, sometimes divergent, parameters. This finding suggests that it justifies the development of a medical program to ensure continuity of care. This should include early identification of patients, an education program to help patients manage their chronic disease, and an evaluation of the quality of care. Finally, it should be noted that optimized management and renovation of pre-existing dialysis facilities is profitable for the patient and for the low-income population.

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