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Burden of COVID-19 in a Hemodialysis Center in Sub-Saharan Africa

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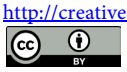

Abstract

Background: The current COVID-19 pandemic remains a great challenge to healthcare workers, especially caregivers of patients with chronic diseases. Despite the advances in knowledge on COVID-19, data on COVID-19 in haemodialysis (HD) remains rare in Africa. **Methods:** We conducted a review of records from 2020 May 13th to 2021 June 24th in the HD center of Yaoundé General Hospital. All staff and patients in the HD unit were included. Sociodemographic, clinical, laboratory, and radiological data and patient outcome data were collected. All statistical analyses were performed with SPSS 21.0 software (Chicago, IL). **Results:** In all 30 HD patients and 3 staff members were positive for COVID-19 during the period. The median age of the infected population was 56 years (37.25 - 62). The median dialysis vintage was 42 months (24 - 96). Hypertension (73.3%) and diabetes (36.6%) were frequent comorbidities. About 10% (n = 3) were asymptomatic whereas those who were symptomatic had a mean duration of symptoms of 7 ± 5.6 days. Fatigue (23/30), fever (21/30), cough (14/30) and diarrhoea (11/30) were the main symptoms. Oxygen saturation was low in 36.6% (n = 11) ranging from 82% - 89%. About 50% were admitted in hospital for social isolation; there was no admission in intensive care unit. Three patients (10%) died: 2 for respiratory distress and 1 for severe anaemia. Laboratory test was done in 60% (n = 18) of case and revealed in 72.2% (n = 13) patients low lymphocytes count (median 896/mm^3 [800 - 1513]) and anaemia in 77.7% (median 8.5 g/dl [7.5 - 9.8]). **Conclusions**: HD patients are highly susceptible and HD centres are high risk areas during the outbreak of COVID-19 pandemic.

Keywords

COVID-19, Hemodialysis, Sub-Saharan Africa

1. Background

Since the end of 2019, the world is facing a pandemic due to the novel coronavirus (SARS-CoV-2); more than 200 countries are affected, and as of June 28th 2020, there has been 10,063,319 confirmed cases worldwide. Several cases were reported in Wuhan (China) in December 2019, and due to the rapid spread of the disease, the World Health Organization declared the outbreak a Public Health Emergency of International Concern on 30th January 2020 and a pandemic on 11th March. The first confirmed case in Africa was in Egypt on February 14th. The first confirmed case in sub-Saharan Africa was in Nigeria and the neighbour, Cameroon reported its first case on the 6th of March 2020 [1] [2] [3]. By June 29th, Cameroon registered 12,592 cases with 313 deaths. The burden of disease seems to be lower in Cameroon and on the African continent compared to others. Many hypotheses have been emitted to explain it; however, it's universal that there is a high variability of clinical manifestations. Asymptomatic and mild cases are most frequent and severe cases account for 15%.

The mortality of critically ill patients with SARS-CoV-2 pneumonia is important [4]. Patients on maintenance haemodialysis (MHD) are now recognized to be at high risk and to present with severe forms [5]; this could be explained by the overload in public transport, high concentration in waiting rooms and compromised immune function. But till now, the real impact of COVID-19 pandemic on HD patients has not been largely reported [6].

With this retrospective summary of cases of COVID-19 amongst patients and staff in a single haemodialysis unit, we share our experience from March to June 13th 2020, when we had a COVID-19 outbreak.

2. Methods

2.1. Study Design and Participants

We conducted an observational single-centre study at the HD unit of the Yaoundé General Hospital is which is the only dialysis unit for COVID-19 cases in the capital city. The unit has 22 functional dialysis machines (Fresenius® 4008S Fresenius Medical Care Germany, Bad Homburg, Germany) distributed as shown in **Figure 1** with one hand washing sink in each room. The unit has 2 entrances: one for COVID-19 patients and one for others. Synthetic polysulfone membrane dialysis and bicarbonate buffer are being used. The centre operates from Monday to Saturday, from 5 a.m. to midnight, with three shifts of approximately 65 patients daily. Most patients receive two HD sessions of 4 hrs duration per week. The permanent staffs include 4 nephrologists, 4 to 6 doctors in training and 19 qualified support staff.

All patients on maintenance HD and dialysis staff were observed and screened on a regular basis once from the date of the first laboratory-confirmed case (May 13, 2020) of COVID-19 infection to June 30, 2021 (2 months after the last confirmed case). For nursing and medical staff, all were requested to monitor their temperature at home and before starting work, and to consult in case of fever,

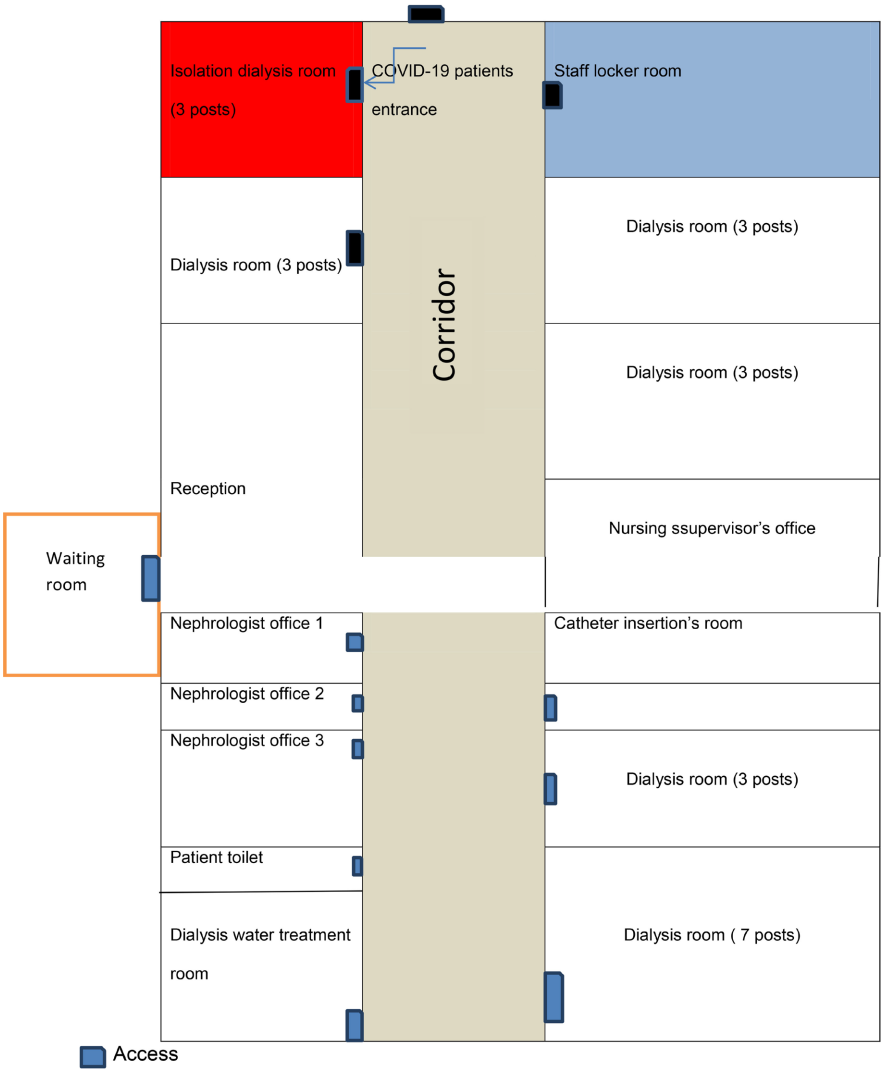

Figure 1. Plan of the hemodialysis unit.

flu-like symptoms or any COVID-19 suggestive symptoms. Wearing of protective equipment (cap, gloves and surgical mask), hand-washing, rigorous cleaning and disinfection of beds and all surfaces in the dialysis room with chlorine solution were reinforced and made compulsory for the staff were patients encouraged to wear face mask.

2.2. Dialysis Scheme

As shown in **Figure 1**, there was no contact between COVID-19 patients and others in the dialysis unit. COVID-19 positive patients were dialyzed in a dedicated room of 3 generators maintained at 1.5 meter from each other and 2 nurses were assigned for dialysis alternating every 2 days. Patients were dialyzed in the isolation room till they became negative (with rapid antigenic testing), usually after 14 days. There was no modification of dialysis program nor protocol. The dialysate composition was as follows: sodium 138 mmol/L, potassium 2.0 mmol/L, calcium 1.75 mmol/L, magnesium 0.5 mmol/L, chloride 109.5 mmol/L, bicarbo-

nate 32 mmol/L, acetate 3 mmol/L, and glucose 1.0 g/L. Ultrafiltration was programmed according to clinical state of the patient (blood pressure, oedema) because patients were not allowed to use the only scale of the unit. All patients on MHD had a permanent vascular access.

2.3. Terms Definition

Cases were defined according to the Guidelines for the prevention, detection and management of the renal complications of COVID-19 in Africa [7]: a case of COVID-19 was defined as a person who was tested positive for the SARS-CoV-2 pathogen in accordance with testing standards, irrespective of clinical signs and symptoms. A suspected case referred to a person who develops a fever ≥ 37.5˚C or respiratory symptoms such as coughing or difficulty breathing with pulmonary lesions suggestive of SARS-CoV-2 on chest computed tomography (CT) scan. Patients with respiratory distress, high grade fever or altered general state were hospitalized in public isolation centres; asymptomatic patients and those with mild symptoms were quarantined at home with re-evaluation before each dialysis session.

2.4. Testing

During the study, depending of their availability, real-time reverse transcriptase-polymerase chain reaction (rtPCR) or antigenic testing (STANDARD™ Q COVID-19 Ag Test) was used for testing for presence of SARS-CoV-2 in a nasopharyngeal swab samples. Blood tests done included complete blood count, CRP, D-Dimers and Lactate Dehydrogenase (LDH). Chest X-ray or CT scan was done at time of the diagnostic. Laboratory parameters were measured at diagnosis and when possible 14 days later. But all these blood and radiological test were out of pocket of the patient because of no health coverage and then not always available. CT scan was request for suspected case; ground glass lesions in patients without fluid retention were considered compatible with SARS-coV-2 infection.

The study protocol was approved by the Ethics Committee of the Yaoundé General Hospital. Written informed consent was obtained before inclusion.

2.5. Data Collection

The medical records of all participants were analyzed by the research team of the hemodialysis unit. Clinical, laboratory, and radiological characteristics and outcomes data were obtained using data collection forms from medical records.

2.6. Statistical Analysis

Qualitative variables were represented with their frequency distribution; quantitative variables were summarized with their mean ± standard deviation or median (interquartile range). All statistical analyses were performed using SPSS 21.0 software (Chicago, IL).

3. Results

A total of 198 patients on MHD and 27 staff (19 nurses, 3 nephrologists and 5 fellows) were included in this study. The main underlying nephropathy was hypertensive nephropathy and none was in an immunosuppression regimen. Figure 2 shows COVID-19 epidemic course in our HD center. The first patient was tested positive for COVID-19 on May 13th, 2020. We performed 4 rtPCR and 10 Ag tests. We reported only 1 suspected case.

3.1. Patients and Clinical Characteristics

During the study period, 27 out of 198 HD patients and 3 out of 27staff were diagnosed corresponding to an overall prevalence of 13.3 %, with 19 (63.3%) males and 40% (n = 12) aged more than 60 years. Characteristics of the COVID-19 patients are presented in Table 1. Globally, the age ranged from 30 to 66 years with a median of 56 years (37.25 - 62). Median dialysis vintage was 42 months (24 - 96). About 22 (73.3%) patients had hypertension, 11 (36.6%) were diabetic and 1 had HIV. Only 3 (10%) persons were asymptomatics and for others, the mean duration of symptoms before the first consultation was 7.09 ± 5.61 days (ranging from 3 to 21 days).

In all 33.3% (10/30) of COVID-19 positive patients were admitted in the public covid-19 isolation center, and no patient was admitted in intensive care unit. The most common symptoms at admission were fatigue (85.1%), fever (77.7%), cough (51.8%) and diarrhoea (40.7%). A severe hiccup at the presentation was reported in one patient.

An oxygen saturation level less than 95% was observed in 11 (36.6%) patients with a severe hypoxemia in 3 patients Clinical pulmonary condensation syndrome was bilateral in 23.3% of patient.

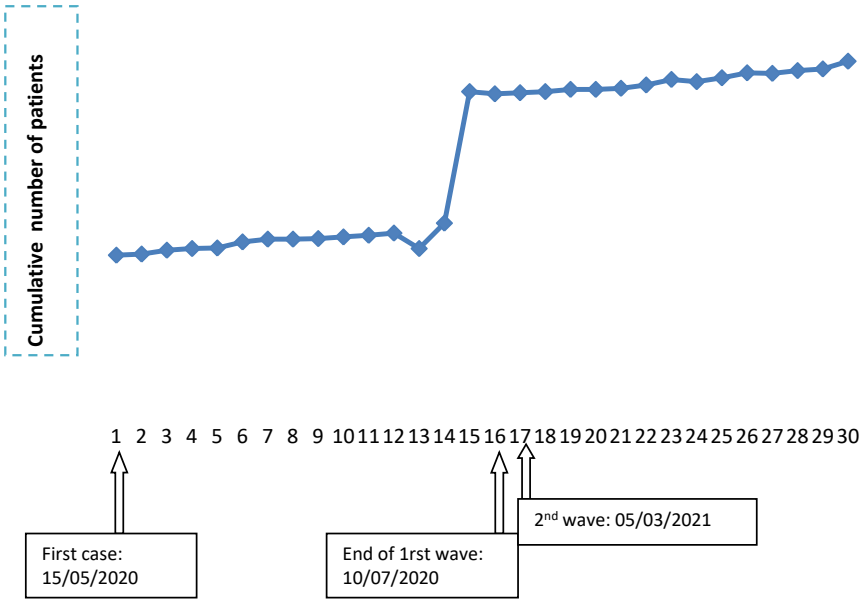

Figure 2. COVID-19 epidemic course in our HD center.

Table 1. Demographic and clinical characteristics of the patients at baseline.

	TOTAL N = 30	**First wave** Frequency (%) n = 14	**Second wave** Frequency (%) n = 16
Male sex	19 (63.3)	9 (64.3)	10 (62.5)
Age ≥ 60 years old		5 (35.7)	7 (43.7)
Mean age [*IQR*]	12 (40)	52.5 [41.25 - 60.75]	57.5 [32.75 - 64]
Dialysis vintage [*IQR*]		42 [26.25 - 60.25]	48 [24 - 105.5]
Hypertension	22 (73.3)	9 (64.3)	13 (81.2)
Diabetes mellitus	11 (36.6)	4 (28.6)	7 (43.7)
Signs and symptoms at admission			
Asymptomatic	3 (10)	3 (21.4)	0
Symptomatic	27 (90)	11 (78.5)	16 (100)
Fever	*21* (*77.7*)	*9* (*81.8*)	*12* (*75*)
Fatigue	*23* (*76.6*)	*8* (*72.7*)	*15* (*93.7*)
Cough	*14* (*51.8*)	*6* (*54.5*)	*8* (*50*)
Dyspnea	*8* (*29.6*)	*6* (*54.5*)	*2* (*12.5*)
Diarrhea	*11* (*36.6*)	*3* (*27.3*)	*8* (*50*)
Muscular pain	*5* (*18.5*)	*3* (*27.3*)	*2* (*12.5*)
Vomiting	*4* (*14.8*)	*3* (*27.3*)	*1*(*6.2*)
Hiccups	*1* (*3.7*)	*1* (*9*)	*0*
Initial physicals signs			
Respiratory distress (SpO_2 < 95%)	11 (36.6)	8 (57.1)	3 (18.7)
Bilateral pulmonary condensation	7 (23.3)	6 (42.8)	1(6.2)
Normal pulmonary exam	24 (80)	8 (57.1)	15 (93.7)
Dehydration	4 (13.3)	3 (21.4)	1 (6.2)

3.2. Biological and Radiological Characteristics

Laboratory exams were done only for 18 peoples as shown in Table 2. All the patients had mainly lymphopenia and anaemia. The median haemoglobin and lymphocyte level was respectively 8.5 g/dl [7.5 - 9.8] and 896/mm^3 [800 - 1513]. There were 4 cases with thrombocytopenia. C-reactive protein was positive in 14/30 patients (median 48 mg/l [12 - 92]). D-dimer was done in 9 patients and the median was 21,200 µg/l (1734.9 - 3569).

Chest X-ray was performed in 11 cases and showed no anomalies in 7 cases, unilateral lung basal opacity in 2 cases and in 5 cases bronchial wall thickening. For the 1 suspected case, chest scanner revealed multiple "ground-glass opacity" lesions in more than 40% of the lung fields.

3.3. Treatment

All symptomatic patients received daily during 10 days a course of 2 g Amoxicillin + clavulanic acid, 500 mg Azithromycin, 10 mg Zinc tablets, artemisinin combined with lumefantrine and one dose of 100,000 units of native vitamin D tablets. Enoxaparin 1 mg/kg/day and dexamethasone 4 mg start was given to patients with poor oxygen saturation during hospital admission following by a

Table 2. Blood routine examination and chest CT scan findings of hemodialysis patients with COVID-19.

	First wave	Second wave
Blood exams*		
Leukopenia	1 (14.3)	8 (72.7)
Neutropenia	5 (71.4)	2 (18.1)
Lymphopenia	7 (100)	6 (54.5)
Anaemia	7 (100)	7 (63.6)
Thrombopenia	1 (14.3)	3 (27.2)
CRP > 6 mg/l	6 (85.7)	8 (72.7)
Radiologic exams		
Ground-glass opacity**	3 (100)	1 (100)
Bilateral patchy shadowing***	2 (66)	3 (42.8)
Unilateral patchy shadowing***	1 (33)	1 (14.3)

*blood tests were done on 7 patients during first wave and 11 patients during 2nd wave; **Chest scan done on 3 patients during first wave and 1 patient during 2nd wave; ***Chest Xray done on 4 patients during first wave and 7 patients during 2nd wave.

10 days of 0.5 mg/kg/day of prednisone and 10 mg of Rivaroxaban. None received Hydroxychloroquine or Remdesevir. There was no hemorrhagic disorder reported.

3.4. Mortality

Three (10%) patients died during the observation period. Two were diabetic with severe respiratory distress and one had a decompensated severe anemia (no blood available for emergency transfusion). All have less than 60 years. The was no reported medical staff death.

4. Discussion

We share our experience of COVID-19 outbreak in a haemodialysis unit of a resource limited country. A total of 27/198 haemodialysis patients and 3/27 staff members were infected within a period of 52 weeks, giving an overall prevalence of 13.3% in our centre. The median age of the affected population was 56 years (37.25 - 62) with a male predominance (sex ratio M/F 1.72), 93.3% positives cases and 90% were symptomatic. We reported 3 deaths.

This prevalence as in the general population is lesser than what is reported from Asia and Europe. It is also lower than reports from other dialysis centres like Zhongnan Hospital of Wuhan University [8] and of two dialysis clinics in Paris [9]. According to data from the Wuhan Hemodialysis Quality Control Centre on February 21, 2020, up to 8.69% were found to be suffering from or suspected to be infected with COVID-19 and there is a similar predominance of infection in the male group [6] [9] [10]. Our population seemed to be younger

than that of Spain and Wuhan, reflecting the younger age of ESKD in Africa. The impact of the COVID-19 on male sex is in concordance with the male predominance on dialysis as reported in Cameroon [11]. Also, the population on dialysis is younger than developed countries explaining the age of positives cases [11]; the mean age in the Spain study was 71 ± 12 years.

Our clinical picture is similar to the findings of a case series of hospitalized COVID-19 patients in Spain [6]: Fever, fatigue, diarrhoea and muscle pain were the most common symptoms; They are non-specific manifestations of infection in dialysis patients. There was no reported case of anosmia. There was no admission in intensive care unit for invasive ventilation and only half of the patients needed oxygen therapy less frequently than in Spain [6]. HD Patients with COVID-19 presented mild clinical signs and were unlikely to progress to severe pneumonia due to the impaired cellular immune function and incapability of mounting cytokines storm.

Although not all patients could afford the recommended laboratory tests as per the COVID-19 guideline in the country, lymphopenia and anaemia were very common and the d-dimer levels were high. Anaemia is common in patients on HD in our milieu due to limited access to erythropoietin (EPO) [12]. Lymphopenia was frequent in the course of chronic kidney disease [13] and could not be used as a marker of the COVID-19 infection. Lymphocytopenia on the other hand, was frequent but the decrease in number cannot predict the disease severity [6] [9]. Patchy shadowing and ground-glass opacities were the most common changes on chest imaging as in other published data [14].

We used commonly reported treatment protocols and despite the small size of our serie, it may be possible that the early use of corticosteroid can explain the no need for invasive ventilation. There is a low mortality rate related to COVID-19 in our population comparing to elsewhere [6] and determinants of this outcome where different than in huge serie of Turgutalp *et al.* [15]: patient where less than 60 years, only 29% of patients with dyspnoea and no thrombopenia.

Although our study included some important information, it has several limitations. We do not know the incidence of SARS-CoV-2 infection in our dialysis facility. The Sequential Organ Failure Assessment (SOFA) scores were not included in the dataset and there is little paraclinical information. Also, evaluate the effects of COVID-19 on long-term outcomes will be interesting.

5. Conclusion

HD patients are a highly susceptible population and HD centres are high risk area during the outbreak of COVID-19. This study though of small size can permit us to give the same recommendation than other with additionally, a systematic nasopharyngeal SARS-CoV-2 nucleic acid test and blood routine test periodically. For those who are negative but have high clinical suspicion, a chest CT scan is useful to confirm the diagnosis. Patients with diabetes may be a high-risk population and need closely care.

What Is Already Known on This Topic

Despite the reputation for having fragile state health systems, the spread of COVID-19 in Africa seem to be lower than other parts of the world. There is no real explanation and burden of the disease in vulnerable groups is still to describe.

What This Study Adds

The experience of a resource-limited health facility.

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Authors' Contributions

Concepts	MM, AG, NA
Design	MM, AG, KFF
Definition of intellectual content	MM, NA, FMH, NG, NV
Literature search	MM, NA, FMH, NG, NV, AG
Clinical studies	MM, NA, FMH, MK, NG, NV
Data acquisition	MM, NA, MK
Data analysis	MM
Statistical analysis	MM
Manuscript preparation	MM, AG, KFF
Guarantor	MM

Conflicts of Interest

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

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