COVID-19 Outbreak in a Hemodialysis Center: A Retrospective Monocentric Case Series

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Abstract

Background: The rapid worldwide spread of COVID-19 has posed a serious threat to patients treated with kidney replacement therapy (KRT). Moreover, the impact of the disease on hemodialysis centers, the patients, and the health care workers is still not completely understood.

Objective: We present the analysis of a COVID-19 outbreak in a hemodialysis center in Belgium and report the incidence, clinical course, and outcome of the disease.

Design: A retrospective cross-sectional cohort study.

Setting: A hemodialysis center during the COVID-19 outbreak.

Patients: A total of 62 patients on maintenance hemodialysis at a tertiary care center in Belgium attended by 26 health care workers.

Measurements: Baseline patients' characteristics were retrieved. The incidence, clinical course, and outcome were reported. The differences between COVID-19 survivors and nonsurvivors were assessed along with the differences between COVID-19-hospitalized and nonhospitalized patients. The incidence of the disease and outcome of health care workers were also reported.

Methods: Proportions for categorical variables were compared using the Fisher exact test and χ^2. The Mann-Whitney rank sum test was used to compare continuous variables. Univariate analysis and a binomial logistic regression were used to explore variables as predictors of death.

Results: Between March 6 and April 14, 2020, 40 of 62 (65%) patients tested positive for severe acute respiratory syndrome beta coronavirus 2 (SARS-CoV-2) along with 18 of 26 (69%) health care professionals. Twenty-five (63%) of the infected patients were hospitalized with a median time for hospitalization-to-discharge of 8 (interquartile range [IQR] = 4-12) days. Eleven (28%) COVID-19-related deaths were recorded with a median time for onset of symptoms-to-death of 9 (IQR = 5-14) days. Lymphocytopenia was prevalent among the cohort and was found in 9 of 11 (82%) reported deaths (P = .4). There was no influence of the use of angiotensin-converting enzyme inhibitors or angiotensin II receptor blockers on COVID-19-related deaths (P = .3). Advanced age, cardiovascular disease (CVD), and obstructive sleep apnea syndrome were all found to be significantly related to death. Of the 18 infected health care professionals, 13 (72%) were symptomatic and 2 (11%) were hospitalized. There was no reported death among the health care workers.

Limitations: Limited follow-up time compared with the course of the disease along with a small sample size.

Conclusions: Patients treated with KRT show a high mortality rate secondary to COVID-19. CVD and age are shown to impact survival. Proactive measures must be taken to prevent the spread of the virus in such facilities.

Trial Registration: Not applicable as this is a retrospective study.

Introduction

Since December 2019, the world has been shaken by the emergence of the Corona Virus Disease 2019 (COVID-19), in Wuhan, Hubei Province, China. COVID-19 is caused by a novel severe acute respiratory syndrome beta coronavirus 2 (SARS-CoV-2).[1,2] The pathogen was found to follow an insidious path with a high person-to-person transmission,[1,3,4] including asymptomatic infected subjects.[5] Due to the rapid spread of the disease across the globe, the World Health Organization declared it a pandemic on March 11, 2020.

Clinical symptoms secondary to COVID-19 range from mild to severe. The most common manifestations are fever and pulmonary symptoms reported in 84% and 31% of cases, respectively.[6] About 2% to 10% of patients might also develop gastrointestinal symptoms,[7] while others only present with anosmia.[8] Large-scale epidemiological data indicate a significantly higher mortality rate due to SARS-CoV-2 infection for elderly patients and/or patients with comorbidities, such as cardiovascular disease (CVD), chronic lung disease, diabetes, and cancer.[9,10] Patients treated with kidney replacement therapy (KRT) by maintenance hemodialysis face an increased complication rate due to the advanced age of the population and various comorbid conditions.[3,11] Logistics at hemodialysis centers, such as physical proximity and frequent visits, contribute to higher rates of disease transmission.[11] Consequently, this situation poses great challenges to patients, health care workers, and hemodialysis centers. The EUDIAL (European Dialysis Working Group) working group recently published recommendations for the prevention of SARS-CoV-2 infection and mitigation among the dialyzed population.[12] Other clinical guidance for safeguarding hemodialysis patients were also published from several centers.[13,14]

To this day, only 1 unpublished series of 230 patients treated with KRT from Wuhan University[15] can be found, along with a few scattered published case reports of infected subjects on maintenance hemodialysis.[16,17] Very few epidemiological data are available regarding COVID-19 outbreaks in hemodialysis centers, with still unpublished data by Li et al,[18] and recently published data by Wang[19] along with data from the experience in Italy.[20]

The first reported case of SARS-CoV-2 infection in Belgium was reported on February 4, 2020. The patient was an asymptomatic worker screened after returning from China, and authorities imposed a lockdown on March 13, 2020, after a rapid spread of the disease.

The objectives of this case series are to (1) describe the clinical characteristics of a cohort of patients treated with KRT treated by chronic hemodialysis and affected, together with their caregivers, by an outbreak of COVID-19; (2) compare the clinical characteristics of the cohort's COVID-19 survivors versus nonsurvivors; (3) assess the relevant factors that may explain the outbreak and impact the prognosis of these COVID-19 patients along with the temporal pattern of their infection, hospitalization, and death; and (4) present actions taken for the mitigation and containment of this outbreak.

Materials and Methods

The Institutional Review Board (IRB) at the Centre Hospitalier Universitaire et Psychiatrique de Mons-Borinage (CHUPMB) reviewed and approved the study protocol on April 15, 2020. The board waived the requirement for written consent.

Study Design

This is a retrospective, monocentric, cross-sectional case series carried out between March 6 and April 14, 2020, evaluating patients on chronic hemodialysis at a tertiary care center in Belgium. This center follows the Belgian authorities' recommendations for set-up in terms of layout and health care workers. Three hemodialysis units are available within the hospital site: a main unit, divided into 2 rooms with 10 and 4 machines, respectively; a secondary unit with 6 machines; and a nearby satellite unit with 10 machines. The units are managed by a total of 26 medical professionals.

Primary physicians from the center retrospectively collected and assessed data from clinical medical records of patients treated at the hemodialysis center. Demographic, epidemiological, and clinical information, including laboratory and radiological findings, were obtained. Patients were divided into a COVID-19 survivor group and a COVID-19 nonsurvivor group. Categorical variables were described as frequency rates and percentages, and continuous variables were described using the median (interquartile range [IQR]).

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Proportions for categorical variables were compared using the Fisher exact test and χ^2. The Mann-Whitney rank sum test was used to compare continuous variables. Univariate analysis and a binomial logistic regression were used to explore variables as predictors of death. Variables were chosen for the binomial regression on the basis of the univariate analysis. All variables with a *P* value of less than .05 in the univariate analysis were included in the binomial logistic regression. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated for each covariate.

Definition and Laboratory Confirmation

A confirmed COVID-19 case was defined as a symptomatic patient with a positive result by real-time reverse transcription polymerase chain reaction (RT-PCR) assay for SARS-CoV-2 from an upper respiratory specimen (nasopharyngeal swab). Early criteria for a nasopharyngeal swab test were fever and highly suspicious symptoms, including dyspnea, cough, rhinorrhea, sore throat, headache, and diarrhea. A second swab test was performed in case of a negative first test.

Fever was defined as tympanic temperature of at least 38.0°C. Pulmonary symptoms were defined as cough, sputum production, or dyspnea.

The COVID-19 severity index (CSI) used was a pulse O_2 saturation (SpO_2) of less than 93% on room air/O_2 supplement or an arterial oxygen partial pressure to fractional inspired oxygen ratio (PaO_2/FiO_2) of less than 300.[21] Patients who met any of these criteria with a confirmed RT-PCR were considered to exhibit a severe course of the disease.

Results

Demographic and Clinical Characteristics

The studied population included 62 patients treated with maintenance hemodialysis at the center and 26 caregivers. Loss of follow-up was documented for 1 asymptomatic patient who died at home. This patient was known to have a mental disorder and refused dialysis care due to the ongoing pandemic, and did not meet the criteria for a nasopharyngeal swab test. All other patients underwent RT-PCR from nasopharyngeal swabs for the detection of SARS-CoV-2.

Table 1 lists the patients' overall characteristics. Over a 4-week period after the first positive RT-PCR test, 40 of 62 (65%) patients tested positive. The median age of infected patients was 75 (IQR = 68-83) years, and 23 (58%) of the patients were men. Of the 40 patients, 37 (93%) had systemic hypertension, 26 (65%) had diabetes, and 25 (63%) had concomitant CVD. Fever was reported as a presenting symptom in 23 (58%) patients followed by pulmonary symptoms in 17 (43%). A total of 11 (28%) patients were asymptomatic. Among the 26 health care professionals, 18 (69%) were found to have a positive RT-PCR test, of whom 3 were practitioners, 14 were nurses and 1 was a practical

nurse. Of the 18 health care workers, 13 (72%) were symptomatic, including 2 practitioners, 9 nurses, and were instructed to self-isolate during at least 7 days and until respiratory symptoms and fever subsided for 3 consecutive days based on the national recommendations,[22] and 2 (11%), including 1 nurse and 1 practical nurse, were hospitalized. There was no reported death among the health care professionals. Following the national recommendations[22] and the severe shortage in health care professionals along with a national lack of specific primer probes, the remaining asymptomatic health care workers remained active at the hemodialysis center and were assigned to confirmed infected patients, and a nasopharyngeal swab test was not repeated prior to resuming activity.

Treatment and Clinical Outcomes

The first symptoms (dyspnea and cough) were reported on March 6 in 1 of 2 already hospitalized patients, coinciding with the development of symptoms in 3 members of the health care workers. The second patient also developed fever and cough later. On March 11, the first swab to detect SARS-CoV-2 infection by RT-PCR was requested following a highly suspicious chest computed tomography scan suggesting COVID-19 pneumonia.[24] On March 12, a technical problem with the water treatment system emerged in the main hemodialysis unit leading to the emergent referral of 30 patients to the secondary unit, the nearby satellite unit, and another hospital center. By April 14, 18 of the 26 (69%) members of the health care team had been infected, and 25 (63%) patients had been hospitalized based on the severity of symptoms and clinical deterioration (O_2 desaturation <93% on pulse oximetry)[21] and/or impaired general status. Among hospitalized patients, 8 (20%) had been discharged with a median hospitalization-to-discharge time of 8 (IQR = 4-12) days and a median onset of symptoms-to-discharge time of 12 (IQR = 8-16) days. A total of 11 (28%) COVID-19-related deaths were recorded. The median time of onset of symptoms-to-death was 9 (IQR = 7-12) days, and the median hospitalization time was 9 (IQR = 3-16) days. One patient was admitted due to elevated C-reactive protein (CRP) levels but was asymptomatic. Three (8%) patients were admitted to the intensive care unit (ICU) (1 reported death) with a median time spent in the ICU of 15 days. Two of these required mechanical ventilation along with vasopressor support. These patients were treated by 4 hours of maintenance hemodialysis thrice a week. There were neither ICU restrictions nor a limited number of ventilators available at our center, but a prior no-escalation of care decision was taken by a multidisciplinary team for 10 of the 11 hospitalized patients on KRT who died based on their baseline ill-prognosis and multiple comorbidities. Figure 1 depicts the progression of the total number of patients by date during the study period.

The use of angiotensin-converting enzyme inhibitors (ACE-Is) or angiotensin II receptor blockers (ARBs) did not

Table 1. Patient Characteristics.

Parameter	COVID-19 survivor			P value
	Outpatient	Hospitalized	Total	
Part 1: Comparison of COVID-19 Survivors				
N	15	14	29	
Age, y (IQR)	74 (66-82)	69 (61-78)	71 (63-79)	.6
BMI, kg/m² (IQR)	29.7 (27.5-31.9)	28.9 (20.9-37.4)	29.6 (26.4-32.8)	.5
Sex, No. (%)				
Male	6 (40.0)	8 (57.1)	14 (48.3)	.4
Female	9 (60.0)	6 (42.9)	15 (51.7)	
CVD, No. (%)	9 (60.0)	5 (35.7)	14 (48.3)	.2
Hypertension, No. (%)	14 (93.3)	12 (85.7)	26 (89.3)	.5
Diabetes mellitus, No. (%)	11 (73.3)	8 (57.1)	19 (65.5)	.3
Chronic lung disease, No. (%)	4 (26.7)	5 (35.7)	9 (31.0)	.5
OSAS, No. (%)	3 (20.0)	3 (21.4)	6 (20.7)	.6
Neurological disease, No. (%)	1 (6.7)	2 (14.3)	3 (10.3)	.5
Cognitive impairment, No. (%)	1 (6.7)	3 (21.4)	4 (13.8)	.3
Neoplasm, No. (%)	1 (6.7)	1 (7.1)	2 (6.9)	.7
Hematological disease, No. (%)	1 (6.7)	0 (0.0)	1 (3.4)	.5
Immunodeficiency, No. (%)	1 (6.7)	5 (35.7)	6 (20.1)	.07
Cirrhosis, No. (%)	2 (13.3)	1 (7.1)	3 (10.3)	.5
Smoking, No. (%)	1 (6.7)	1 (7.1)	2 (6.9)	.7
ACE-I/ARB treatment, No. (%)	5 (33.3)	5 (35.7)	10 (34.5)	.6
Inaugural symptoms, No. (%)				
Fever	3 (20)	12 (85.7)	15 (51.7)	<.001
Pulmonary symptoms	3 (20)	7 (50.0)	10 (34.5)	.1
Asymptomatic	10 (66.7)	0 (0.0)	10 (34.5)	<.001
Lymphocytopenia, No. (%)	8 (53.3)	13 (92.9)	21 (72.4)	.02
Saturation <93% on presentation,[a] No. (%)	0 (0.0)	5 (35.7)	5 (17.2)	.02
Saturation <93% during the disease' course[a] (CSI), No. (%)	0 (0.0)	12 (85.7)	12 (41.4)	<.001
Positive chest CT-scan,[b] No. (%)	0 (0.0)	8 (57.1)	8 (27.6)	.001
Hydroxychloroquine treatment, No. (%)	0 (0.0)	12 (85.7)	12 (41.4	<.001
Antibiotics treatment,[c] No. (%)	2 (13.3)	10 (71.4)	12 (41.4)	.002

Parameter	All patients	COVID-19 survivor	COVID-19 nonsurvivor	P value
Part 2: Comparison of COVID-19 survivors and COVID-19 nonsurvivors				
N	40	29	11	
Age, y (IQR)	75 (68-83)	71 (63-79)	78 (73-82)	.02
BMI, kg/m² (IQR)	29.7 (26.1-33.4)	29.6 (26.4-32.8)	30.8 (25.2-36.5)	.5
Sex, No. (%)				
Male	23 (57.5)	14 (48.3)	9 (81.8)	.06
Female	17 (42.5)	15 (51.7)	2 (18.2)	
CVD, No. (%)	25 (62.5)	14 (48.3)	11 (100)	.002
Hypertension, No. (%)	37 (92.5)	26 (89.3)	11 (100	.4
Diabetes mellitus, No. (%)	26 (65.0)	19 (65.5)	7 (63.6)	.6
Chronic lung disease, No. (%)	16 (40.0)	9 (31.0)	7 (63.6)	.07
OSAS, No. (%)	12 (30.0)	6 (20.7)	6 (54.5)	.05
Neurological disease, No. (%)	4 (10.0)	3 (10.3	1 (9.1)	.7
Cognitive impairment, No. (%)	5 (12.5)	4 (13.8)	1 (9.1	.6
Neoplasm, No. (%)	3 (7.5)	2 (6.9)	1 (9.1)	.6
Hematological disease, No. (%)	2 (5.0)	1 (3.4)	1 (9.1)	.5
Immunodeficiency, No. (%)	7 (17.5)	6 (20.1)	1 (9.1)	.4
Cirrhosis, No. (%)	3 (7.5)	3 (10.3)	0 (0.0)	.4
Smoking, No. (%)	3 (7.5)	2 (6.9)	1 (9.1)	.6
ACE-I/ARB treatment, No. (%)	12 (30.0)	10 (34.5)	2 (18.2)	.3
Inaugural symptoms, No. (%)				
Fever	23 (57.5)	15 (51.7)	8 (72.7)	.2
Pulmonary symptoms	17 (42.5)	10 (34.5)	7 (63.6)	.1
Asymptomatic	11 (27.5)	10 (34.5)	1 (9.1)	.1
Lymphocytopenia	30 (75.0)	21 (72.4)	9 (81.8)	.4
Saturation <93% on presentation,[a] No. (%)	14 (35.0)	5 (17.2)	9 (81.8)	<.001
Saturation <93% during the disease' course[a] (CSI), No. (%)	22 (55.0)	12 (41.4)	10 (90.9)	.005
Positive chest CT-scan,[b] No. (%)	11 (27.5)	8 (27.6)	3 (27.3)	.7
Hydroxychloroquine treatment, No. (%)	20 (50.0)	12 (41.4)	8 (72.7)	.08
Antibiotics treatment,[c] No. (%)	21 (52.5)	12 (41.4)	9 (81.8)	.03

Note. IQR = interquartile range; BMI = body mass index; CVD = cardiovascular disease; OSAS = obstructive sleep apnea syndrome; ACE-I = angiotensin-converting enzyme inhibitor; ARB = angiotensin II receptor blocker; CSI = COVID-19 severity index; CT-scan = computed tomography scan.

[a]Saturation at room air or on oxygen.

[b]Defined as images suggestive of COVID-19 (peripheral, bilateral ground-glass appearance of infiltrates).[23,24]
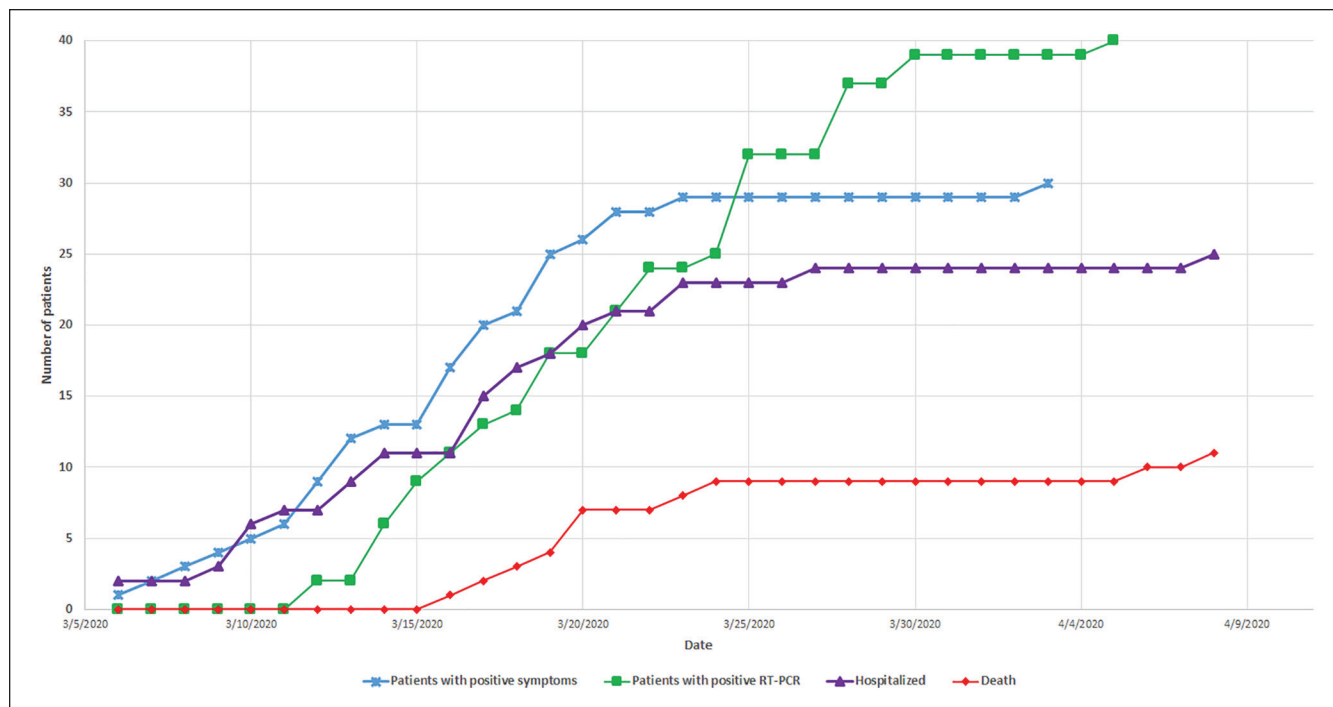
[c]Antibiotics and antiviral treatment.

Figure 1. Temporal evolution of clinical events.

show any statistically significant difference in COVID-19-related deaths ($P = .3$). Advanced age was found to be related to a significantly higher rate of death ($P = .02$), as was CVD ($P = .002$). A slightly statistically significant higher rate of death in patients with obstructive sleep apnea syndrome (OSAS) was noted ($P = .05$).

Lymphocytopenia was reported in 30 (75%) patients, and was found in 9 of the 11 (82%) reported deaths ($P = .4$). Of the 25 hospitalized patients, 20 (80%) received hydroxychloroquine treatment early after hospitalization during the course of the disease, of whom 8 (40%) died ($P = .08$). Patients who received hydroxychloroquine had a statistically significant higher CSI ($P < .001$). Three patients among hospitalized and overall patients on KRT who did not receive hydroxychloroquine treatment (n = 5 and 20, respectively) died. These patients had multiple comorbidities along with significant in-hospital clinical deterioration, and a palliative treatment was favored. Two of the remaining hospitalized patients presented mild symptoms and survived. Of the 40 patients, 21 (53%) received antibiotic and/or antiviral therapy, and 9 (42.8%) of these died ($P = .025$). A binomial logistic regression run from sex, CVD, OSAS, CSI, treatment with hydroxychoroquine, use of antibiotics did not show any significant predictor of death but was borderline for CSI ($P = .06$).

Discussion

SARS-CoV-2 is currently one of the primary pathogens of respiratory infections worldwide. Although several drugs and vaccines are under investigation, there are no effective therapies or vaccines available yet for COVID-19.[25-28] Here, we report the incidence, clinical course, and outcome of a COVID-19 outbreak at our hemodialysis center. These facilities are at high risk of respiratory infection outbreaks,[26] as attested to in our study with the high person-to-person transmission rate and a high incidence of infection (63%) found among patients. By April 14, a total of 58 confirmed cases were identified, including both patients and health care workers. The rapid transmission rate in our facility posed a serious threat to this medically vulnerable population and put a strain on the local health care professionals. Due to the technical problem that emerged, several patients were transferred to the satellite unit and another center. This contributed to limiting the spread of the disease. In our patient cohort, the clinical presentation of COVID-19 during the prodromal phase was insidious, leading to a rapid spread of SARS-CoV-2 among the population. The management of patients was challenging due to (1) the fact that the patients had a "silent hypoxemia" phase presenting with mild symptoms, and (2) the multiphasic parity of the disease (including a viremic phase and subsequent adaptive immunity) before deterioration. The recurrent interaction, physical contact/proximity, and the limited qualified health care workers also highly contributed to the higher incidence rate. Hospitalized patients had a more aggressive course of the disease and a higher CSI.

Currently, the approach to COVID-19 is to control the source of infection, reduce the risk of transmission by the use

of personal protective equipment (PPE), and test early for diagnosis, isolate, and provide supportive treatments for affected patients. Upon detection of the first laboratory-proven case on March 11, airborne and contact precautions were implemented at our facility as per the guidance of the American Society of Nephrology (ASN),[18] the *Société Francophone de Néphrologie Dialyse Transplantation* (SFNDT),[29] Centers for Disease Control and Prevention (CDC),[30] the European Centre for Disease Prevention and Control (EDCD),[31] and the Canadian Society of Nephrology.[32] Also implemented were ongoing patient and health care worker education regarding hand and respiratory hygiene, as well as cough etiquette. Furthermore, health care workers were educated on the selection and use of PPE. The hemodialysis waiting area was adapted to decrease social interaction with a minimal distance of 1.5 m between patients, and when applicable, patients were asked to wait in their cars. A triage plan to identify patients with fever or symptoms of respiratory infection before they entered the treatment area was implemented. Patients were instructed to call ahead to report fever and/or suspicious symptoms, including dyspnea, cough, rhinorrhea, sore throat, headache, and diarrhea. Temperature and pulse oxygen saturation were measured regularly before and after the hemodialysis session. Patients were assigned to separate units according to their infection status: asymptomatic, symptomatic suspected, or confirmed cases. By March 12, due to the lack of appropriate masks, the entire health care professionals team and patients were required to have a surgical mask on during their presence at the hemodialysis unit; in addition, visitors were not allowed in the unit. As of March 17, filtering facepiece masks 2 (FFP2) were used by the circulating nursing staff when caring for suspected and/or confirmed patients. Furthermore, nurses were required to wear protective gowns, gloves, and protective face shields. Protective curtains were placed when the distance between 2 hemodialysis stations was less than 2 m (the distance between 2 stations in the main unit was of 1.4 m). By March 27 and April 2, all patients and health care professionals had been tested, respectively. Patients were considered recovered 28 days after the first positive SARS-CoV-2 swab test and following 2 negative swab tests 48 hours apart.

The mortality rate secondary to SARS-CoV-2 infection has been reported to reach up to 10%,[25] with mortality rates of patients admitted to the ICU and in need of mechanical ventilation as high as 78%.[33] Our findings demonstrate a high mortality rate (28%) in patients treated with KRT. Older age has been reported in several studies as a risk factor for mortality in COVID-19 patients.[33,34] This was confirmed in our study, which showed a statistically significant better survival rate for younger patients. Male sex has also been associated with a higher rate of infection and mortality.[34] Hypertension and CVD were linked to higher morbidity and mortality in SARS-CoV-2 infection.[33] Our data were also aligned with the literature for CVD, but not for hypertension.

No influence was shown regarding the use of ACE-I or ARB, and this has also been suggested by recently published data on their mechanisms during COVID-19.[35,36] Obesity was shown to be prevalent among patients admitted to the ICU and has been linked to a more severe course of COVID-19.[37] Although our cohort presented a relatively high median body mass index (BMI), no significant difference was found between the 2 groups. We also noted a slightly statistically significant higher rate of death in patients with OSAS. Whether this is due to the pathophysiology of OSAS or the overall chronic lung disease and obesity is still open for investigation.

Of the 62 patients, 40 (65%) were presumed to have been infected at the hemodialysis center, including 2 patients (3%), who were already hospitalized for other reasons, and 18 health care workers (78%). Personnel-to-patient and patient-to-patient transmission are also presumed to have occurred.

Finally, hydroxychloroquine was administered in 20 hospitalized patients with an aggressive course of the disease according to the interim clinical guidance for adults with suspected or confirmed COVID-19 in Belgium.[21] Hydroxychloroquine failed to show any statistically significant difference between the 2 groups of our cohort. Twenty patients were started on antibiotics for suspected bacterial pneumonia or another bacterial infection, and 1 other patient received oseltamivir for a positive influenza A virus RT-PCR test. These patients were also found to have a higher CSI on diagnosis.

To the best of our knowledge, this is the first report of an outbreak of COVID-19 in a hemodialysis center in Belgium. Our results are in line with the recently published data from Lombardy, Italy, showing a high in-hospital mortality rate (52%).[20] Besides unpublished data of 230 hemodialysis patients with 37 patients infected with SARS-CoV-2 (16%) without any reported death along with 4 of the staff members (12%),[15] there are limited data on COVID-19 mortality in patients treated by KRT. A larger-scale study should be undertaken for further investigation of this predisposed and frail population.

Limitations

This case series has several limitations. First, it was a retrospective review. Second, the follow-up time was relatively short compared with the course of the disease, and the reported mortality data and length of stay data reported in this study could change. Third, the sample size was limited.

Conclusion

In this single-center case series of 40 SARS-CoV-2-infected patients treated with maintenance hemodialysis, the high mortality rate was linked to advanced age and CVD. In the current context of rapidly emerging outbreaks around the

globe, proactive measures should be taken in facilities to prevent the introduction and spread of the virus among more vulnerable populations.

Ethics Approval and Consent to Participate

The Institutional Review Board (IRB) at the Centre Hospitalier Universitaire et Psychiatrique de Mons-Borinage (CHUPMB) reviewed and approved the study protocol on April 15, 2020. The board waived the requirement for written consent.

Consent for Publication

Not applicable.

Availability of Data and Materials

The data sets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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