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COVID-19 patients on hemodialysis: a hospital experience

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ABSTRACT

Introduction: SARS-CoV2 represents a challenge for hemodialysis (HD). By August 24 2020, the disease had affected 55720 people in Portugal. The northern Minho province has had 4428 cases. The Minho has 870 HD patients among 11 ambulatory HD centers and the Nephrology Department of Braga Hospital. Braga Hospital centralized HD treatments of COVID-19 patients. We describe our experience managing these patients.

Results: We used a 2-station room and dedicated nurse with PPE but, as numbers increased, HD was performed in the main HD room. Disinfection protocols and specific routes were created. Swabs were repeated 14 days after diagnosis and then weekly until recovery. A total of 17 HD COVID-19 patients were diagnosed in the Minho, 16 of which performed HD in Braga Hospital. The first patient was diagnosed on March 16 and the last on May 5. Ten were males, mean age 60.6±13.2 years and median dialysis vintage 38.5 months (IQR 23.5-85.8). Four patients were diabetic and 10 were hypertensive. Only 1 of the 5 hospitalized patients was admitted for symptoms attributable to COVID-19. One developed severe respiratory insufficiency; 3 took hydroxychloroquine and 1 died. The 11 patients on ambulatory care had mild or no symptoms. At diagnosis, the mean hemoglobin was 10.1±1.8g/dL; mean leukocytes count 6.5±3.4x10/µL; mean platelet count 161±7x10/µL and mean LDH 241±148U/L. Median C reactive protein was 11.3mg/L (IQR 1.6- 23.8). Patients' swabs turned negative after a mean of 22±10 days. No association was found between the duration of a positive swab and gender, diabetes or hypertension.

Discussion: Compared with the general population, Minho HD patients had a higher incidence of cases, possibly due to an increased risk and more testing. Incidence and mortality were lower than in other series. Centralizing infected patients may help prevent the spread of the disease and reduce the burden on HD centers.

Keywords: COVID-19, SARS-CoV2, Hemodialysis

INTRODUCTION

Since December 2019, SARS-CoV2 has become a global pandemic and represents a challenge for hemodialysis (HD) patients due to their comorbidities, weakened immune systems and increased age. Furthermore, sharing the facilities with other patients during HD sessions increases the risk of contamination. The severity of COVID-19 varies from an asymptomatic course to a severe viral pneumonia with need for critical care[1].

Around the world, different hemodialysis units have set in motion protocols to minimize the risk of infection for patients and staff[2]. These include reinforcement of hand and respiratory hygiene, use of personal protective equipment (PPE), spacing patients, individual transport to the HD unit, a triage protocol at arrival, separating patients in isolated rooms and frequent testing.

In Portugal, since the end of January 2020, the Directorate General of Health (Direção Geral de Saúde – DGS), has issued several recommendations on the management of COVID-19 patients. On March 25 and March 28, specific recommendations concerning patients on HD were released. The latter established that all patients and staff should wear masks inside the HD unit and also that transportation from home to the dialysis unit should preferably be individual although exceptionally a maximum of 3 patients in a 9-seater vehicle could be carried. Units should guarantee a separation between SARS-CoV-2 positive and negative patients, dedicated staff, and more rigorous PPE.

The first case of COVID-19 in Portugal was reported on March 2 and by August 24 the disease has affected 55,720 people. Of these, 40,880 have recovered and 1801 have died[3]. The northern Minho province, with 1.2 million people, has had 4428 cases (0.37% of its population)[3]. Minho has 870 HD patients among 11 ambulatory HD centers and the Nephrology Department of Braga Hospital. Home HD is not performed in this region.

Some reports show different prevalence, case fatality rates and approaches to HD patients. Several risk factors for mortality have been identified, such as increased age, male gender, diabetes, hypertension, obesity, chronic lung disease and cancer[4,5,6]. Chronic kidney disease has been found to be a risk factor for mortality among hospitalized patients[7]. However, the prognosis remains unclear because, although some report an increased mortality[8], others have found a reduced mortality among infected HD patients[1] and suggest a possible benefit of a weaker immune reaction.

Since the beginning of March, patients have been subject to a temperature and clinical screening at the beginning of each HD

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treatment and all suspected cases sent for a nucleic acid testing via a throat and nasopharyngeal swab. If positive, most centers performed swabs on all other patients sharing the facility. To reduce disease propagation, Braga Hospital centralized HD treatments of COVID-19 patients. Because evidence about the disease is still limited and HD patients have special organizational requirements, we aimed at describing our experience concerning patient management and their clinical characteristics.

SUBJECTS AND METHODS

We describe the general prevention measures developed at the Nephrology Department of Braga Hospital in a timely manner and the problems faced by the staff from March until our last COVID-19 patient in May 2020. We also conducted a retrospective observational study gathering data from all HD patients with COVID-19 who performed HD at our hospital. A follow-up on the patients was made in August 2020.

SARS-CoV-2 infection was established by reverse transcription polymerase chain reaction (RT-PCR) on nasal and oropharyngeal swabs in patients with symptoms suggesting the disease. Later in March, asymptomatic patients sharing HD units where COVID-19 patients had been detected or patients admitted to the hospital for any reason were also tested. The decision to admit SARS-CoV-2 patients to the hospital was made at the emergency department by the attending physician considering the severity of the disease. In some cases, the cause of admission was unrelated to COVID-19. Even for those who were considered stable to be discharged home, the Braga Nephrology Department assumed their HD treatments on an ambulatory basis in coordination with their original HD unit. Swabs were repeated 14 days after diagnosis and then weekly, until recovery.

We collected clinical and laboratory data on all HD COVID-19 patient who performed dialysis in Braga Hospital. Statistical analysis was performed using IBM SPSS Statistics 25. Descriptive statistics concerning percent and numbers for categorical variances and mean and median for continuous variables were used. We compared proportions of patients using a χ^2 test and continuous variables using an independent sample t-test.

RESULTS

In line with the DGS recommendations, the Nephrology Department of Braga Hospital transferred all chronic HD patients performing treatments on an ambulatory basis to other units in the Minho in order to expand its capacity to receive COVID-19 HD patients. Another reason was that, during the first weeks of March, few tests and PPEs were available, hospitalized patients on HD transitorily sharing the same facilities with chronic ambulatory patients as well as members of the staff were found to be SARS-CoV-2 positive and it was difficult to guarantee safety and maintain the same routine as previously.

A total of 17 HD COVID-19 patients were diagnosed in the Minho (1.9% of all HD patients), 16 of which performed HD in Braga Hospital: 5 as hospitalized and 11 as outpatients. Only 1 patient continued HD treatments at his ambulatory HD unit. The first patient was diagnosed on March 16 and the last on May 5. The patients came from 9 different HD units although the majority belonged to clusters from 2 of them. No other HD patients were diagnosed with COVID-19 until the end of August.

The staff of the HD unit of the Nephrology Department of Braga Hospital included 10 nurses, 5 medical auxiliaries and 10 physicians. Of these, 3 nurses and 1 medical auxiliary were infected with SARS--CoV-2 and were sent home on a sick leave. Three of them were tested after developing symptoms. At that point, a universal staff screening was performed, detecting 1 asymptomatic staff member.

In March and April, we used a 2-station isolation room with a HEPA filter (Hospi-Guard®) and dedicated nurse with PPE. In May, as numbers increased, HD was performed in the main HD room at the end of the day. Disinfection protocols and specific routes were created, allowing ambulatory patients inside the hospital through a dedicated entrance.

Of the 16 patients, 10 were males, their mean age 60.6±13.2 years and median dialysis vintage 38.5 months (IQR 23.5-85.8). Four patients were diabetic and 10 were hypertensive (5 used renin-angiotensin inhibitors). Ten had an arteriovenous fistula (AVF). The most common causes of kidney disease were diabetic kidney disease (4 patients) and glomerular diseases (7 patients). Four patients were diabetic and 10 were hypertensive (5 using a renin-angiotensin system inhibitor).

Only 1 of the 5 hospitalized patients was admitted for symptoms attributable to COVID-19, the others had unrelated problems. Of these 2 were found positive after developing cough during hospital stay and 2 were diagnosed at an admission screening. The only patient who developed severe respiratory insufficiency and required non-invasive ventilation was an 82-year-old hypertensive man with chronic osteomyelitis. Three patients took hydroxychloroquine (2 with azithromycin and 1 with lopinavir/ritonavir). One patient died due to an unrelated cause (infected ischemic diabetic foot). Of the 11 patients on ambulatory care, 3 had mild and 8 had no symptoms. In this small sample, no association was found between the severity of the clinical characteristics and gender, diabetes, hypertension or the use of renin--angiotensin system inhibitor ($p>0.05$).

At diagnosis, the mean hemoglobin was 10.1±1.8g/dL; mean leukocytes count 6.5±3.4x10 /µL (21.7±7.2% lymphocytes); mean platelet count 161±7x10 /µL and mean LDH 241±148U/L. Median C reactive protein was 11.3mg/L (IQR 1.6- 23.8).

Patients' swabs turned negative after a mean of 22±10 days (max. 38 days). No association was found between the duration of a positive swab and gender, diabetes or hypertension ($p>0.05$).

Until August 2020, 3 of these cured HD COVID-19 patients came to the emergency department for 1) chest pain attributed to a panic attack, 2) a urinary tract infection with an associated altered mental state and 3) symptomatic hypervolemia. No deaths occurred in this period.

DISCUSSION

So far Portugal has had about 5,300 cases per million population, representing one of the highest rates in Europe. Portugal has also

performed a higher number of tests than neighboring countries such as Spain, France and Italy, and this may explain the relatively lower percent of deaths[9].

Information regarding the epidemiologic and clinical characteristics of COVID-19 in HD patients is still scarce and heterogeneous.

Hemodialysis patients seem more susceptible to COVID-19 not only because of their impaired immune function but also because most need to travel to and attend HD sessions in close proximity to other patients and staff. In our experience, in the Minho, 1.9% of HD patients were infected, a larger percent than that of the province's general population (0.4%). However, more testing in the HD population could have detected relatively asymptomatic patients who would otherwise have been missed. Other authors have reported higher incidences of COVID-19 in HD patients. In a report from Genoa[10], 17 out of 260 patients (6.5%) had COVID-19; in Brescia[8], 94 out of 643 patients were infected (15%) and in a Center in Wuhan[11] 42 out of 230 patients were positive for the virus (18.3%). Different screening methods and effective measures started soon after the first cases in Portugal may explain our results. In fact, most facilities tested patients with and without symptoms sharing the same HD shift whenever a positive case presented.

Regarding our 16 patients, there was a slight male predominance which probably reflects the fact that there are more men on dialysis. The mean age was 60, which was inferior to that of the country's HD population[12] and significantly inferior to the Spanish COVID-19 Registry where the mean age was 71[13]. This may also explain why we had less severe symptoms and a lower mortality.

The HD population was found to be susceptible to more severe forms of COVID-19, according to a meta-analysis including 4 Chinese studies[14]. In our series, half of the patients remained asymptomatic throughout infection, while the rest developed mild manifestations such as fever and upper respiratory symptoms. Only one of our eldest patients developed a severe pneumonia. The rate of asymptomatic patients varies across studies. In one HD center in Spain, the rate of asymptomatic patients was 25.4%[15] and in a study from China[16] it was 21.4%. Different screening policies may explain these diverse results. Having such a large asymptomatic group reinforces the importance of large-scale screening in HD patients. In the general population most asymptomatic patients were younger and healthy[17] and possible risk factors identified by other authors were age, the male gender, diabetes, hypertension, taking renin-angiotensin-system inhibitors as well as laboratory values such as lymphocytopenia. None of these were increased in prevalence in our symptomatic patients although our sample was too small to withdraw conclusions.

We had an AVF and deep vein thrombosis in one of our patients. Although hemodynamic instability may have helped, a prothrombotic state associated with COVID-19 could have played a role. Other authors have also described a thrombosed AVF[18] and a higher incidence of thrombotic episodes in COVID-19 patients[19].

Published data about the prognosis of HD patients varies considerably. We have registered 1 death, corresponding to a 5.9% fatality rate, slightly above the 3.48% observed in Portugal so far[3]. Although this death could not be directly attributable to COVID-19, other studies have revealed a higher fatality rate secondary to cardiovascular events and bacterial infections[4,8,10,16] which, in some cases, are the leading causes of death[11].

Some studies have demonstrated the importance of T-cell immunity in the recovery from COVID-19[20]. Uremia affects the function of lymphocytes and granulocytes[21]. A study in Wuhan[11] showed that, compared with the general population, HD patients had reduced level of T cells, Th cells, killer T cells, NK cells as well as reduced serum level of serial cytokines of IL-4, IL-6, TNF-α during COVID-19 infection. This may attenuate the risk of an excessive and dysregulated cytokine elevation during severe infections which by itself can be deleterious[22,23].

In general, our experience compares favorably with other series. Centralizing infected patients and the early introduction of specific measures recommended by the DGS may have helped prevent and control the disease in the Minho. In fact, since May 5, no more cases have been detected among HD patients in this province. Universal screening, isolating patients with COVID-19 and using designated hemodialysis centers were found to be effective measures in other settings[16], reducing the number of cases after implementation. Information on the clinical behavior of COVID-19 in HD patients as well sharing the results of contingency plans and protocols concerning this vulnerable group aim at mitigating a serious sanitary, political and social problem created by this disease.

Disclosure of potential conflicts of interest: none declared

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