Portable low-flow daily home haemodialysis monitor to cope with the COVID-19 outbreak

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Pandemic severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (coronavirus disease 2019, COVID-19) is a public health emergency. Such a situation is characterized by both high contagiousness and morbidity in elderly and comorbid populations, but also by a capacity for extension and propagation spread over very variable periods ranging from a few weeks to several years [1]. Patients on haemodialysis (HD), an ageing population with frequent comorbidities, are more likely to develop serious infectious diseases than the general population. In addition, they are treated often (two to three times per week in HD centres), and due to patients clustering during dialysis shifts are exposed to a higher risk of contamination than the general population for whom a containment strategy is possible.

Another challenge specific to the HD system is the need for specialized resources and healthcare teams. In our French University HD centre during the outbreak, 281 chronic HD patients were followed-up. On 12 March 2020, we adopted surveillance measures for outpatients undergoing HD and set up a dedicated COVID-19 programme (Figure 1). For more mobility/flexibility, our choice of HD monitor was portable equipment usually dedicated to low-flow daily home HD (S3 Physidia monitor), allowing us to dialyse either as outpatient HD or during hospitalization in single rooms. The duration of training for HD nurses on this monitor is 2–3 h, which allowed us to quickly develop a strong, dedicated team and to implement this solution in our hospital (two to three COVID-19 HD nurses during the day and one on call during the night, 24/7).

HD sessions are prescribed as followed:

• HD session of a maximum duration of 3 h with for patients requiring chronic care, three sessions maximum per week;
• 3-h HD session with blood flow 250–300 mL/min and dialysate flow 170 mL/min max; and
• per-dialysis anticoagulation is prescribed whenever possible due to the very pro-inflammatory condition of the patients.

More than 100 HD sessions have been carried out since the start of this programme. Thirty-six patients have been included, among them 11 (3.9%) patients actually infected with COVID-19. For COVID-19 suspected patients, only one S3 Physidia HD session per patient was performed before determining the negative Reverse Transcriptase PCR (polymerase chain reaction) result. The 11 patients infected with COVID-19 (5 women and 6 men) ranged in age from 53 to 85 years old. Nine of 11 patients were exposed to COVID-19 either by contact with an infected individual (n = 4) or by direct exposure in a contagious environment (patients with a community lifestyle in subacute care and rehabilitation sites, home nursing care, etc.). A large number of patients were hospitalized and often for more than a week (2–29 days). Most of them, because they had a fever, received antibacterial treatment. No antiretroviral therapy, glucocorticoids or hydroxychloroquine was administered. No non-invasive ventilation was required. To date, all patients have been discharged. Despite their biological status of hypercoagulability during COVID-19 infection, no patient had a pulmonary embolism or a dialysis vascular access thrombosis. It should be noted that six of them are on long-term anticoagulant therapy. For the others, during hospitalization, a preventive anticoagulant treatment was always administered. Finally, to date, neither any HD nurse in the COVID-19 programme nor in our HD centre, nor any HD medical staff has been infected with COVID-19. Preserving the safety of HD patients as well as the specialized healthcare team in charge of these patients is a real issue, which has led to planning different management strategies from one centre to another. To date, several recommendations to contain the spread of infection in dialysis patients have been published [2–6]. Here, we describe our experience, which, during this complex period, has shown various advantages. First of all, we promptly detect new suspected COVID-19 cases so as to trigger an appropriate response including rapid diagnosis, case isolation and management, with to date a limited number of patients infected with COVID-19 and no case among medical/nurse staff. To date, we have had no deaths. In our department, the Franche Comté, very close to a cluster (Mulhouse, Alsace, at 130 km from our University Hospital) the situation on May 5 is as follows: 33 patients infected with COVID-19.
COVID-19 including 7 who died. With 545 dialysis prevalent patients in our region listed on the last Réseau Epidémiologie et Information en Néphrologie registry report in 2017, we estimate the proportion of patients infected in the region and outside our ‘HD centre activity’ at 8.3% [22 HD patients infected with COVID-19 and among them 7 deaths (31.8%)/264 prevalent HD patients]. COVID-19 infection at the Wuhan City Dialysis Centres was up to 10% among patients and 6% among medical staff with a mortality rate up to 10%, compared with 4% in the Chinese general population [7]. Secondly, three important points are taken into account in this strategy. (i) Do not mix COVID-19 and non-COVID-19 HD cases: we systematically isolated the cohort of chronic HD patients from any patient suspected and/or infected with COVID-19. Patients suspected of infection were also systematically isolated from infected patients. Indeed, using the portable device has enabled us to always dialyse patients in single room wherever they are, even when hospitalized. It also allows us to avoid patients movement within the hospital, and thus potentially avoids the risk of spreading disease in the hospital. (ii) Always keep our HD centre nurses safe from contact with suspected/infected patients. (iii) Ensure COVID-19 patient safety during dialysis: sessions are performed during the day, which is a more comfortable situation for managing patients at such high risk. Finally, this solution was implemented quickly, and allowed us in a very short time to manage effectively all suspected patients

**FIGURE 1:** Management of chronic HD patients suspected or infected with COVID-19 during the outbreak period.
and/or patients infected with COVID-19 in response to the urgent need during this complex pandemic situation.

Currently, the situation is improving in our region. However, we know that the time when the epidemic will end depends on a variety of factors and is unpredictable. That is why this solution in the weeks and months to come remains available to meet any need, whatever its scale.

**CONFLICT OF INTEREST STATEMENT**
None declared.

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