



The COVID-19 infection in dialysis: are home-based renal replacement therapies a way to improve patient management?

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The novel coronavirus initially called SARS-CoV-2 (Severe Acute Respiratory Syndrome Corona Virus 2), and subsequently renamed COVID-19 (Corona Virus Disease 2019) was identified in Wuhan, China in December 2019. Since then, it has spread worldwide, and in some countries it has had an exponential, and initially unexpected, impact. It was declared a pandemic in March 2020 by the World Health Organization. The elderly and patients with comorbid conditions such as hypertension, heart disease, diabetes, lung disease, and immunologic disorders were soon identified as being at risk of contracting a severe infection [1].

Various measures of containment were undertaken to prevent the spread of COVID-19, initially without in-depth knowledge of the clinical and epidemiological characteristics of the virus. Patients with advanced chronic kidney disease (CKD), in particular, those on dialysis are a vulnerable population and a challenge in the prevention and control of the disease. As the virus is transmitted through droplets and contact, treatments that need to be performed in limited, dedicated spaces require special care; hemodialysis units can be taken as the prototype of such settings [2, 3].

In northern Italy, we were the first in Europe to have to cope with the need to continue to manage our chronic dialysis patients while continuously adapting to the rapidly evolving emergency situation. Hundreds of patients were diagnosed as affected by COVID-19 in Italy's northern regions, where the pandemic first hit, and the figures are probably underestimated, due to the low availability of tests, especially during the first phase of the epidemic. For example, in two of the of the largest renal units in Milan, near the epicenter of the Italian epidemic, where 330 hemodialysis (HD) patients and 50 peritoneal dialysis (PD) patients are followed, we tried to reduce exposure and the risk of contagion by decreasing the number of patients per shift in order to provide safe distance between patients during hemodialysis. To do so, we rapidly equipped additional treatment space with ten hemodialysis stations and added dialysis shifts. However, this led to staff shortages, which were already critical as members of the health care team had been infected. Although new stations were added, treatment time had to be shortened wherever clinically possible. In our Unit, 20 HD and 1 PD patient were diagnosed as having COVID-19 and 5 died.

Peritoneal dialysis patients were relatively spared and the advantages of this technique rapidly became evident, as did the importance of monitoring [4, 5].

Now that the epidemic is reaching a plateau, it is time to reflect on the lessons that could, and probably should transform our models of delivering dialysis. Outpatient, thrice-weekly hemodialysis is the standard of care in most countries, including Italy; dialysis delivery is often, probably too often, performed in a standardized way, and the population of mainly elderly and high-comorbidity patients often passively receives this intrusive, albeit life-sustaining treatment.

Under the pressure of need, we were obliged to tailor hemodialysis sessions to mediate between logistics and clinical priorities. This mediation further highlights how an incremental dialysis strategy, based on number of sessions as well as their duration, can be safe and patient-friendly

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Table 1 Logistic considerations regarding home dialysis treatments, and potential interferences in times of crisis

	Advantages	Limits	Potential interference in case of epidemic
Home-based treatment	Makes it possible to limit exposure to the hospital setting	Isolation. Acute intradialytic problems can be challenging	Less exposure to the hospital milieu; links should be reinforced using telemedicine
Remote counseling	A good way to avoid isolation; should integrate direct follow-up	Fragile and elderly patients may not be able to clearly explain their problems	May need to be increased during epidemics to avoid isolation. An “urgent pathway” has to be ensured
Flexibility—empowerment	Patient empowerment is associated with better survival and better quality of life	Patient-designed dialysis may differ from prescriptions. This can be dangerous	Remote counseling should be reinforced, to avoid the introduction of subtle but important changes to prescriptions
Biochemical controls at home	Practical, reduces the need for going to a laboratory or hospital	Standard pre- and post-dialysis controls may be difficult to organize	Care needs to be taken so that the frequency of controls is not reduced (except in acute epidemic phases)
Family involvement	Can provide important psychological support	The burden may be heavy and create tension	Psychological aid could be needed, and would need to be reinforced in moments of crisis
Residual kidney function	May be better preserved in tailored dialysis programs	Monitoring may be difficult to carry out, and slow loss of kidney function could go unnoticed	Particular attention needs to be paid if only remote monitoring is employed
Assisted home dialysis	Allows limiting exposure to the hospital setting and eliminates travel time	May fail to guarantee privacy. The advantage of empowerment is usually lost	Aids are exposed to contagion and become potential carriers
Reduction of travel time—lower carbon footprint	The ecologic advantages are debated, but are likely to be relevant especially if patients live far from the dialysis units	In some settings, the costs for the patients may be high. Waste management needs to be organized in advance	Limiting need to travel is an advantage in case of lockdown
Other	The clinical results of home dialysis are usually at least competitive with hospital-based therapy	Home dialysis may be time consuming for the health care team, in particular if a personalized schedule is chosen	Delivering supplies may prove difficult to organize during lockdown; technical aid may be delayed. Home dialysis has to be a clear priority for technical aid and delivery of disposables

for many subjects with some residual kidney function [6]. During an epidemic incremental approaches play an important role in limiting exposure; implementing the lessons in times of less pressure could lead to a personalized approach that limits morbidity, respects residual kidney function and minimizes iatrogenic impact. However, tailoring dialysis can be time consuming, and requires frequent monitoring. If on the one hand this could be seen as too demanding for overcrowded dialysis wards, the spare time for the patient and cost for the society could theoretically be reinvested in dedicated physician's time (Table 1).

The issue of personalized incremental dialysis is intrinsically linked with home dialysis, in both HD and PD. The present epidemic has highlighted some of the limits of standard, thrice-weekly outpatient hemodialysis: it lacks flexibility, and large units are often preferred, given their economies of scale [7, 8].

Home-based renal replacement therapies have many advantages in this regard. First of all, they offer the opportunity to manage patients remotely, thus reducing contagion during an epidemic. The French health council, as well as some patients' associations, recently underlined the importance of developing home dialysis choices to respond to the COVID crisis. Home dialysis involves making patients responsible for their own care and patient empowerment facilitates personalization of treatment. In this regard, the Advancing American Kidney Health Initiative (AAKHI) underlines that home dialysis should be promoted as an opportunity for patients to be engaged in their own treatment. Flexibility applies not only to dialysis itself, but also to diet and, more widely, to lifestyle. The list of advantages of home dialysis is long and encompasses better preservation of residual kidney function, at least in PD and incremental hemodialysis, saving time, limiting travel from center to home and vice versa, lower costs (this issue is somewhat controversial), and possibly a smaller carbon footprint [9].

Home dialysis is however underdeveloped, for clinical, cultural and economic reasons [8]. In-hospital dialysis is often seen as simpler for the nursing staff and less demanding for the patient; since it is standardized it is also thought to reduce the physician's involvement. Are these real advantages?

To face this crisis, many dialysis physicians had to invent solutions overnight, and, overall, succeeded in doing so.

The same flexibility and innovation should be applied to an in-depth revision of our practice, promoting home-based therapies: tailor-made schedules, assisted home dialysis, strict telemonitoring, and home visits can be combined to make home dialysis possible and often preferable for fragile patients. This may not be simple, but it is certainly feasible (Table 1).

In summary, as we endure this unprecedented catastrophe, we should try to learn from it to improve the care of our vulnerable population. Considering the efficacy of lockdown

in preventing the spread of the infection, home dialysis represents an ideal approach in the case of epidemics. It is a good opportunity for us to reconsider its value, and develop new approaches to make home and personalized treatments more widely available, as a strategic reinvestment not only in these times of crisis, but, even more importantly, in calmer times to come, hopefully soon.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

References

1. Cheng Y, Luo R, Wang K, Zhang M, Wang Z, Dong L, Li J, Yao Y, Ge S, Xu G (2020) Kidney disease is associated with in-hospital death of patients with COVID-19. *Kidney Int* 97(5):829–838
2. Rombolà G, Heidempergher M, Pedrini L, Farina M, Aucella F, Messa P, Brunori G (2020) Practical indications for the prevention and management of SARS-CoV-2 in ambulatory dialysis patients: lessons from the first phase of the epidemics in Lombardy. *J Nephrol* 33(2):193–196
3. Li J, Xu G (2020) Lessons from the experience in Wuhan to reduce risk of COVID-19 infection in patients undergoing long-term hemodialysis. *Clin J Am Soc Nephrol* 15(5):717–719
4. Garofalo C, Borrelli S, De Stefano T, Provenzano M, Andreucci M, Cabiddu G, La Milia V, Vizzardi V, Sandrini M, Cancarini G, Cupisti A, Bellizzi V, Russo R, Chiodini P, Minutolo R, Conte G, De Nicola L (2019) Incremental incremental dialysis in ESRD: systematic review and meta-analysis. *J Nephrol* 32(5):823–836
5. Ronco C, Milan Manani S, Giuliani A, Tantillo I, Reis T, Braun E (2020) Remote management of peritoneal dialysis patients during corona virus epidemic. *Peritoneal Dialysis Int.* <https://doi.org/10.1177/0896860820927697>
6. Wilkie M, Davies S (2020) Peritoneal dialysis in the time of COVID-19. *Perit Dial Int.* <https://doi.org/10.1177/0896860820921657> (Epub ahead of print)
7. Piccoli GB (2020) Hospitals as health factories and the coronavirus epidemic. *J Nephrol* 33(2):189–191
8. Agar JWM, Barraclough KA, Piccoli GB (2019) Home haemodialysis: how it began, where it went wrong, and what it may yet be. *J Nephrol* 32(3):331–333. <https://doi.org/10.1007/s40620-019>
9. Piccoli GB, Cupisti A, Aucella F, Regolisti G, Lomonte C, Ferraresi M, Claudia D, Ferraresi C, Russo R, La Milia V, Covella B, Rossi L, Chatrenet A, Cabiddu G, Brunori G, On the Behalf of Conservative treatment (2020) Physical activity and peritoneal dialysis project groups of the Italian Society of Nephrology. Green nephrology and eco-dialysis: a position statement by the Italian Society of Nephrology. *J Nephrol.* <https://doi.org/10.1007/s40620-020-00734-z> (Online ahead of print)

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