CMI Clinical Management Issues

Editorial

Remote Patient Monitoring: A Plus for Dialytic Efficiency

Silvio Borrelli[1], Vittoria Frattolillo[1], Roberto Minutolo[1], Michele Provenzano[2], Gennaro Argentino[3], Maria Rita Auricchio[4], Giovanni Somma[4], Toni De Stefano[1], Giuseppe Conte[1], Carlo Garofalo[1], Luca De Nicola[1], Maura Ravera[5]

[1] University of Campania "Luigi Vanvitelli", Nephrology Unit, Napoli, Italy
[2] University Magna Graecia, Nephrology Unit, Catanzaro, Italy
[3] Ospedale del Mare, Nephrology Unit, Napoli, Italy
[4] Hospital "San Leonardo", Nephrology Unit, Castellammare di Stabia (NA), Italy
[5] IRCSS University Hospital of "San Martino", Division of Nephrology, Dialysis and Transplantation, Genova, Italy

CMI 2019; 13(1): 49-51
http://dx.doi.org/10.7175/cmi.v13i1.1451

PERITONEAL DIALYSIS

On 15th August 2019, the *New York Times* published an article entitled "The Challenges of Home Dialysis", describing how every day elderly patients "fight" to survive at home [1]. The article highlighted the major challenge launched by Donald Trump: in US by 2025, 80% of new patients with End Stage Kidney Disease (ESKD) will be treated by dialysis at home or will receive a transplant [2]. The difficulties of this challenge become even more significant if we consider that the worldwide number of ESKD patients has been growing, due to ageing of population and increased prevalence of comorbidities [3], and that, currently, incident ESKD starting in US with Peritoneal Dialysis (PD) and Home Hemodialysis (HHD) account for 10% and 2% of whole incident ESKD population, respectively [4]. These numbers are not different from those of other Western countries, where the percentage of new PD patients ranges between 3-20% [5]. This low prevalence is surprising, if we take into consideration the benefits of PD as compared to in-center hemodialysis (HD). Indeed, PD may be associated with an improved survival versus HD, at least in the first dialysis year, is less expensive, is associated with longer preservation of residual kidney function (RKF) and better quality of life [6]. All these reasons candidate PD as first-choice in the treatment of elderly ESKD patients in the next future, possibly with an incremental approach, that allows to maintain RKF longer than full dose [7].

However, there are several obstacles to PD diffusion including structural, economical, organizational, and psycho-social factors. Often nephrologists' reluctance and/or patients' fear limit PD penetration. Indeed, many nephrologists are reluctant to leave patient alone, because of poor compliance or inefficacy of their self-care. On the other hand, patients may not feel confident with PD or may be afraid of adverse events.

TELEMEDICINE

Novel technologies, such as remote patient monitoring (RPM) may help at overcoming these psycho-social barriers, thus increasing PD diffusion. Telemedicine (TM) is a broad definition that describes the exchange of medical information between the healthcare providers and patients in order to improve the management of chronic patients by monitoring them at home with mobile medical devices that collect data about clinical parameters (blood sugar levels, blood pressure or other vital signs). However, currently TM has not yet found wide spread among dialysis patients [8].

From its beginning, TM has been designed to put into communication patients

Corresponding author
Silvio Borrelli MD Nephrology and Dialysis Unit, Med School, University of Campania "Luigi Vanvitelli" PO S.M.d. P. Incurabili, via M. Longo 50 80138 Napoli, Italy
Phone/Fax: +39-081-2549405
dott.silvioborrelli@gmail.com

Received: 5 November 2019
Accepted: 6 November 2019
Published: 26 November 2019

living in far places or in rural areas with small hospitals. In the Nineties, PD was the preferred renal replacement therapy in the rural areas of Canada, suggesting that the first field of interest of TM for PD patients could be the diffusion in remote locations [9]. Indeed, the first experiences of TM in dialysis patients concerned peripheral HD centers, which were connected to central hospital by videoconferencing [10]. Then, Gallar et al. reported 2-year experience with video-dialysis in PD patients, showing that video-dialysis allowed reduction of hospitalization rate and days of hospitalization in spite of higher costs related to the purchase of instrumentations [11]. More recently, Viglino et al. have reported a 20% increase of PD uptake among new ESRD patients in 10 years (2009-2019) by use of video-assistance, allowing to use PD even in those patients who could not do it alone due to physical, cognitive or psychological barriers [12].

REMOTE PATIENT MONITORING INTEGRATION

More recently, a system of RPM has been put in the cyclers for Automated Peritoneal Dialysis (APD) to facilitate the communication between patients and healthcare professional. These technologies provide a two-way real-time communication, thus allowing a quick intervention of healthcare provider to solve clinical problems. For this purpose, the cycler software provides simple reports of treatments concluded by patients, in which any problems are reported by alarm systems (e.g.: red or yellow flags). By this way, healthcare providers can remotely assess the compliance to the PD schedule, and accordingly modify device setting and/or treatment schedule.

RPM has several potential benefits. First, it may increase compliance to the PD schedule.

According to the results of a recent review, the compliance to PD schedules ranged from 3 to 53% [13].

A retrospective study in 92 PD patients reported that non-compliance, defined as performance of less than 90% of dwells prescribed, was detected in 30% and was associated with higher risk of switch to HD due to uremia symptoms, all-cause death, and hospitalization [14].

Second, the care team may readily assess the numbers and types of alarms at the end of each treatment, to diagnose and trouble-shoot solutions to various clinical and/or technical problems, reduce the need in center visits and allow a greater personalization of treatment based on the performance of catheter [14]. Therefore, RPM may allow to change medical attitude from reactive (e.g.: patient realizes to have a problem, then he calls medical staff) to pro-active (e.g. healthcare provider detects a problem, then he calls the patients, who could not yet realize to have it). This capability of RPM allows an earlier diagnosis of problems as well as implementation of timely solutions.

In a recent observational study, 43 APD patients using RPM were compared with an historical cohort of 42 no-RPM patients, showing that the number of prescription modifications was doubled in RPM group, proving a greater possibility of intervening on the PD schedule. As consequence of these modifications, nocturnal alarms and hospital visits were significantly lower in RPM patients vs no-RPM patients. Notably, the Authors also showed a significant reduction of time spent for visits both of patients (4800 minutes) and medical personnel (3673 minutes for physician and 2647 for nurse); furthermore, the distance traveled by patients in the case of RM-APD was reduced by 1134 km with a saving of € 9720, which added to saving of € 9130 for logistics and € 5810 for medical personnel [15].

Similarly, the retrospective study of Sanabria et al. showed that RPM was associated with significant reductions in hospitalization rate and hospitalization days [16].

In a simulation study based on the nephrologists' experience, the Authors estimated that RPM could potentially save $ 1947 per APD patient in the U.S., $ 871 per APD patient in Germany, and $ 571 per APD patient in Italy [17].

CONCLUSIONS

RPM is a great opportunity to improve the efficiency of home dialysis by increasing PD acceptance because it reduces non-adherence and alarms discomfort and personalizes therapy. Earlier diagnosis and fast trouble-shooting may improve the quality of life and the prognosis of PD patients. However, we need more studies proving that RPM is a "plus" for dialysis efficiency.

Funding
This article has been published without the support of sponsors.

Conflicts of interests
All authors declare they have no competing financial interests concerning the topics of this article.

REFERENCES

1. Graham J. The Challenges of Home Dialysis Dialysis at home takes discipline, skill, will and support. Aug. 15, 2019 The New York Times. Available at https://www.nytimes.com/2019/08/15/well/live/the-challenges-of-home-dialysis.html (last accessed November 2019)
2. Contact: HHS Press Office. HHS Launches President Trump's 'Advancing American Kidney Health' Initiative. July 10, 2019. Available at https://www.hhs.gov/about/news/2019/07/10/hhs-launches-president-trump-advancing-american-kidney-health-initiative.html (last accessed November 2019)
3. Liyanage T, Ninomiya T, Jha V, et al. Worldwide access to treatment for end-stage kidney disease: a systematic review. *Lancet* 2015; 385: 1975-82; https://doi.org/10.1016/S0140-6736(14)61601-9
4. United States Renal Data System. Available at https://www.usrds.org/2018/view/v2_01.aspx (last accessed November 2019)
5. Li PK, Chow KM, Van de Luijtgaarden MW, et al. Changes in the worldwide epidemiology of peritoneal dialysis. *Nat Rev Nephrol* 2017; 13: 90-103; https://doi.org/10.1038/nrneph.2016.181
6. Mehrotra R, Devuyst O, Davies SJ, et al. The Current State of Peritoneal Dialysis. *J Am Soc Nephrol* 2016; 27: 3238-52; https://doi.org/10.1681/ASN.2016010112
7. Garofalo C, Borrelli S, De Stefano T, et al. Incremental dialysis in ESRD: systematic review and meta-analysis. *J Nephrol* 2019; 32: 823-36; https://doi.org/10.1007/s40620-018-00577-9
8. Rosner MH, Lew SQ, Conway P, et al. Perspectives from the Kidney Health Initiative on Advancing Technologies to Facilitate Remote Monitoring of Patient Self-Care in RRT. *Clin J Am Soc Nephrol* 2017; 12: 1900-9; https://doi.org/10.2215/CJN.12781216
9. Tonelli M, Hemmelgarn B, Culleton B, et al. Alberta Kidney Disease Network. Mortality of Canadians treated by peritoneal dialysis in remote locations. *Kidney Int* 2007; 72:1023-8; https://doi.org/10.1038/sj.ki.5002443
10. Mitchell BR, Mitchell JG, Disney AP. User adoption issues in renal telemedicine. *J Telemed Telecare* 1996; 2: 81-6; https://doi.org/10.1258/1357633961929835; https://doi.org/10.1177/1357633X9600200203
11. Gallar P, Vigil A, Rodriguez I, et al. Two-year experience with telemedicine in the follow-up of patients in home peritoneal dialysis. *J Telemed Telecare* 2007; 13: 288-92; https://doi.org/10.1258/135763307781644906
12. Viglino G, Neri L, Barbieri S, et al. A pilot experience of telecare for assisted peritoneal dialysis. *J Nephrol* 2019 Sep 16. doi: 10.1007/s40620-019-00647-6. [Epub ahead of print]
13. Griva K, Lai AY, Lim HA, et al. Non-adherence in patients on peritoneal dialysis: a systematic review. *PLoS One* 2014; 9: e89001; https://doi.org/10.1371/journal.pone.0089001
14. Bernardini J, Nagy M, Piraino B. Pattern of noncompliance with dialysis exchanges in peritoneal dialysis patients. *Am J Kidney Dis* 2000; 35: 1104-10; https://doi.org/10.1016/S0272-6386(00)70047-3
15. Milan Manani S, Rosner MH, Virzì GM, et al. Longitudinal Experience with Remote Monitoring for Automated Peritoneal Dialysis Patients. *Nephron* 2019; 142: 1-9; https://doi.org/10.1159/000496182
16. Sanabria M, Buitrago G, Lindholm B, et al. Remote Patient Monitoring Program in Automated Peritoneal Dialysis: Impact on Hospitalizations. *Perit Dial Int* 2019; 39: 472-8; https://doi.org/10.3747/pdi.2018.00287
17. Makhija D, Alscher MD, Becker S, et al. Remote Monitoring of Automated Peritoneal Dialysis Patients: Assessing Clinical and Economic Value. *Telemed J E Health* 2018; 24: 315-23; https://doi.org/10.1089/tmj.2017.0046