The Role of Incremental Peritoneal Dialysis in the Era of the Advancing American Kidney Health Initiative

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CJASN 15: 1835–1837, 2020. doi: https://doi.org/10.2215/CJN.03960320

Introduction

On July 10, 2019, President Trump signed the Advancing American Kidney Health (AAKH) Executive Order—an order that aims to shift care delivery for kidney failure to patient-centered home therapies (1). One main goal of AAKH is for 80% of patients with incident kidney failure to receive a preemptive kidney transplant or home dialysis, consisting of peritoneal dialysis (PD) and home hemodialysis (HD), by the end of 2025 (1). With only 13.4% of patients with incident kidney failure on home therapies in 2017, the AAKH would require a substantial change in care delivery. There are practical challenges to achieving the AAKH home goal—kidney transplantation is limited by organ availability, and home HD is limited by provider and patient misperceptions, complexity and length of training, and limited availability of trained staff and resources (1). As a result, to achieve the AAKH home goal, nearly 80,000 patients with incident kidney failure may need to choose to initiate PD every year (1). For this to occur, the expansion of patient-centered strategies such as incremental PD should be explored, along with parallel efforts to overcome barriers to kidney transplantation and home HD (1,2). This perspective aims to provide an overview of incremental PD, including advantages and limitations of implementing this strategy to help achieve the AAKH goal of optimizing patient-centered home therapies in the United States (2,3).

Incremental Peritoneal Dialysis—Overview

The International Society for Peritoneal Dialysis (ISPD) recently released 2020 guidelines for prescribing high-quality, goal-directed PD (3). Key to the 2020 ISPD guidelines is a focus on shared decision making between the person performing PD, the caregiver (if any), and the care team to achieve realistic care goals that maximize patient satisfaction and provide high-quality care (3). The ISPD suggests using innovative PD care delivery strategies, such as incremental PD—a strategy with the potential to improve patient experience while lowering complication rates and costs. Incremental PD refers to the strategy of prescribing less than the standard "full dose" of PD when initiating PD so that the combination of residual kidney function (RKF) and peritoneal clearance is sufficient to achieve individualized clearance goals; the prescription is increased if (and when) RKF declines (2). An incremental PD prescription consists of any of the following: (*1*) continuous ambulatory peritoneal dialysis (CAPD) with fewer than four dwells daily, <2-L dwell volume, or <7 d/wk or (*2*) automated PD with no day dwell, <10-L total daily dose, or <7 d/wk (2). Notably, incremental PD is initiated at the same time as "full-dose" PD and is not a strategy that favors the early initiation of dialysis.

Incremental Peritoneal Dialysis to Optimize Advancing American Kidney Health—Clinical, Environmental, and Economic Advantages

Clinically, PD expansion under the AAKH home goal carries the risk of unintended consequences, such as technique failure, peritonitis, and membrane failure. Technique failure, defined as a permanent switch from PD to HD, is associated with higher morbidity, mortality, and health care costs (4). Limited but promising observational data suggest that incremental PD has several clinical advantages that can mitigate the risk of these complications (2,5–7). Accessing the peritoneum fewer times per day decreases the opportunity for the entry of infectious organisms and reduces the risk of peritonitis. A randomized controlled trial of 139 patients followed over 2 years demonstrated that three-exchanges per day PD (incremental PD) was associated with a longer peritonitis-free survival compared with four-exchanges per day PD ("full-dose" PD) (5). Although this was a secondary outcome of the trial, the potential for prolonging peritonitis-free survival warrants further consideration. Fewer exchanges can also decrease the burden of care delivery. A retrospective study of 16,748 patients on PD showed that among the non-infectious causes of technique failure, 13.2% and 11.6% were from psychosocial issues or patient preference, respectively (6). Because the burden of care delivery influences these issues, minimizing it could decrease technique failure. In addition, using less solution than "full-dose" PD decreases peritoneal glucose exposure. Prolonged glucose exposure results in the formation of advanced glycation end products that affect peritoneal membrane function. An observational study of 303 patients using PD illustrated that early hypertonic glucose exposure was associated with faster solute transport—a risk factor for

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membrane failure (7). Thus, by minimizing glucose exposure, incremental PD has the potential to prolong the overall longevity of the peritoneal membrane and reduce late-onset technique failure from membrane failure (2,7). In summary, improved utilization of incremental PD could decrease peritonitis, decrease care burden, prolong longevity of the peritoneal membrane, and reduce technique failure.

From a societal perspective, Abra and Schiller (1) project that the AAKH home goal will require 119 million L more of PD solution every year. It is important to assess the environmental and economic effects of this increase in PD solution and the potential mitigating effects of incremental PD. Care delivery for kidney failure has a disproportionately high environmental effect, in part through the generation of nonrecyclable waste from supplies (8). Although PD has a lower carbon footprint compared with HD, CAPD (and likely, automated PD) generates 617 kg of waste per patient per year (8). Currently, 80% of this carbon footprint comes from packaging materials. Until strategies, such as on-demand PD fluid, are commercially available, incremental PD can immediately decrease the PD carbon footprint (8).

Economically, 7% of the Medicare budget ($35.9 billion) is spent annually on care delivery for kidney failure (9). With rising health care costs, strategies that lower health care expenditure without compromising patient-centered outcomes should be strongly considered. Assuming a "full-dose" CAPD prescription of four 2-L exchanges per day, the annual cost of PD solution in 2019, not including delivery costs, ranges from $9500 to $14,000 on the basis of estimates derived from costing data (costing data were obtained from personal communication with the two largest PD solution suppliers in the United States [February 2020]). Assuming an incremental CAPD prescription of two 2-L exchanges per day, this could result in cost savings of $4750–$7000 per patient per year. Stated otherwise, for every 150–200 patients who benefit from incremental PD, payors such as Medicare could save an average of $1 million per year, stemming health care costs without compromising patient outcomes.

Finally, as recently as 2014, PD expansion in the United States was complicated by a PD solution shortage that threatened PD utilization rates (10). Efficient utilization of PD solution through incremental PD can reduce the risk of future solution shortage, which could have consequential effects if the majority of patients with kidney failure are using PD in the AAKH era.

Incremental Peritoneal Dialysis—Limitations and Challenges

Despite these clinical and societal advantages, there are potential limitations and challenges to incremental PD that merit discussion.

First, there is the concern that patients on incremental PD may not adhere to an increase in their PD prescription when RKF declines (2). Because identifying barriers to adherence may be challenging, providers may have previously favored an upfront "full-dose" PD strategy for all patients, regardless of RKF. In keeping with the goal of patient-centered therapy, however, the decision to initiate as incremental or "full-dose" PD should be made alongside an appropriately informed patient through shared decision making. For example, setting expectations with patients for incremental PD with early education on the eventual need to transition to "full-dose" PD can help overcome barriers to adherence and reduce the risk of technique failure.

Second, a common misconception is that incremental PD can result in inadequate dialysis adequacy. The goal of incremental PD is to achieve the same individualized adequacy targets as "full-dose" PD. Although the 2020 ISPD guidelines recommend a focus on patient-centered outcomes as opposed to a specific Kt/V_{urea} target, it is likely prudent to use the trend of Kt/V_{urea} over time (as opposed to the absolute value) to guide clinical decision making for patients on PD, regardless of strategy of incremental or "full-dose" PD (3). In practice, patient symptoms, RKF, and adequacy targets should be monitored, and the prescription should be increased as needed to continue to deliver high-quality, goal-directed PD.

Third, most of the data assessing the effect of incremental PD on clinical outcomes are observational (2). Although there has been no clear evidence of harm to date, patients and providers need to monitor clinical signs and symptoms closely and report outcomes to the broader nephrology community.

The 2020 ISPD guidelines share many common elements with the AAKH goal of providing high-quality patient-centered home therapies for patients with kidney failure. Using the ISPD-redefined strategy of incremental PD can improve the quality of life of patients, decrease peritonitis rates, and prolong time on PD, while simultaneously lowering the environmental and economic effects of dialysis care delivery for eligible patients (2,5,7,8). Therefore, the 2020 ISPD guidelines should receive strong consideration for implementation in the United States to help achieve the AAKH goal of 80% of patients with incident kidney failure receiving patient-centered home therapies by 2025. The AAKH is a major step forward for patient-centered kidney care, and using ISPD-recommended strategies such as incremental PD can help ensure a timely, successful transition to a new era of patient-centered home therapies for kidney failure in the United States.

Disclosures

M. Mendu provides consulting services to Bayer AG. All remaining authors have nothing to disclose.

Funding

Research reported in this publication was supported by National Institute of Diabetes and Digestive and Kidney Diseases grant T32DK007527 (supporting Y. Reddy).

Acknowledgments

The authors acknowledge Dr. John Kevin Tucker, MD, and Terry Moore, RN, for their assistance in obtaining cost data and reviewing key aspects of this perspective. A portion of the data reported here has been supplied by the United States Renal Data System. The interpretation and reporting of these data are the responsibility of the author(s) and in no way should be seen as an official policy or interpretation of the US Government. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

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Published online ahead of print. Publication date available at www.cjasn.org.