Frequent Long Dialysis: Why Do Length and Frequency Help?

By Peter G. Kerr

Most dialysis in the developed world occurs as three sessions per week, typically about 4 hours per session. This provides us with fairly dismal outcomes—yes, we keep people alive for a period of time (hopefully for some, until they are transplanted)—but our outcomes are worse than breast cancer. It is not enough to claim that there have been improvements; we still have a long way to go. Most people working in nephrology accept that this is not something we should sit back and accept—we must strive for improved mortality for our patients. The question arises then: Is it our regimen of dialysis delivery that needs improvement? My tenet is yes, and that it needs to change.

Duration of dialysis

The first issue I would like to examine is time—the length of the dialysis session. There is strong observational data supporting the advantage of longer duration of dialysis sessions. The Dialysis Outcomes and Practice Patterns Study in particular draws on a large database representing (by means of random selection of units and patients) dialysis patients from 13 countries. These data demonstrate significantly improved mortality for relatively small changes in session length (compared with 4 hours per session; hazard ratios for death, 1.18 for 3.5 to 4 hours and 0.78 for 4.5 to 5 hours) (1). Similarly, the ANZDATA Registry in Australia showed major improvements in survival for 5 versus 4 hours per session. Unfortunately, the only randomized, controlled trial that examined this—the Hemodialysis Study, which strictly did not test the influence of time but rather, tested Kt/V, achieved the higher Kt/V predominantly by longer session length (mean 29 minutes difference)—did not show a benefit for the higher Kt/V. There are many reasons why this trial failed to show a benefit, many of which have been debated at length, but in terms of time, it may relate to the session length being under 4 hours, even in the high-dose group (2).

The next step up is prolonged dialysis sessions, such as are commonly practiced in nocturnal hemodialysis. Because of the length of session (typically 8 hours), this format is almost exclusively used in the home. Once again, trial evidence is lacking. Observational data from France, Canada, and Australia suggest that long-hours dialysis results in excellent outcomes, but undoubtedly, there is a selection bias, with home hemodialysis patients being younger, fitter, and more motivated than their peers in facilities. The only randomized, controlled trial to examine this was the nocturnal arm of the Frequent Hemodialysis Network (FHN) Trial, but this trial was significantly underpowered, used a composite end point of death and left ventricular hypertrophy (LVH), and is, therefore, difficult to interpret (3).

An important question to ask is why time helps. Several measurable values are improved with longer hours. These include better fluid management via slower ultrafiltration rates with better achievement of target weight, all while avoiding the use of antihypertensive agents. The achievement of target weight improves BP control and at least in some studies, improves LVH. Slower ultrafiltration rates are associated with better outcomes (4). In addition, although small molecule clearances may have little room for further improvement and at least in the Hemodialysis Study were not associated with improved outcomes, the clearance of larger molecules remains time dependent and is significantly improved by longer session length. This includes phosphate, which behaves like a larger molecule due to its hydration shell.

Many patients using long-hours dialysis do not require phosphate binders, and some even require phosphate supplementation. As another marker middle molecule, β2-microglobulin clearance is also improved with longer hours and again, associates with better outcomes (2).

Increasing the frequency of dialysis

The other issue is frequency. There are two common approaches to increased frequency. The first is simply the avoidance of the long break. Several observational studies have pointed to the problems of the long break in traditional thrice weekly schedules. The main issue is the predominance of deaths clustered around the end of the long break (e.g., Monday morning in a Monday/Wednesday/Friday schedule), presumably related to volume and solute accumulation with more marked electrolyte abnormalities (5). Adopting a schedule of seven dialysis sessions in 2 weeks with no long break avoids this problem. This schedule is commonly adopted in Australian home hemodialysis, and it is associated with improved outcomes and avoids clustering of deaths on Monday morning. With maintenance of session length within these schedules, there is, of course, also an increase in overall hours by 17% per week.

The other approach is to dialyze five to six times per week with either maintained or even longer dialysis sessions (e.g., as seen in some nocturnal schedules) or “short daily” dialysis. The latter model was tested in the FHN Short Daily Trial and was associated with improved outcomes in the composite end point of that trial (6). In the FHN Trial, this model was conducted in facilities; however, this modality again lends itself to home hemodialysis, especially if simpler dialysis setups are used to diminish the burden of preparation for each dialysis session.

Why does frequency help? Fluid management is improved—the amounts of salt and water accumulated between dialysis sessions are low, and the rate of fluid removal is lower (unless adopting short daily schedules), allowing optimization of fluid status and BP control. Small molecule clearance is also improved (Figure 1), and if more hours per week are achieved, middle molecule clearance is improved.

Is there a downside? Time spent dialyzing is increased, and although nocturnal schedules avoid affecting lifestyle, it may make daytime schedules unpalatable. More frequent forula needleling may result in more access problems, such as was seen in the FHN Trial, but this was not seen in other reports of frequent dialysis. Costs may increase, although alternate-day schedules have only a small effect in this regard. Costs are offset by fewer hospital days.

As a final plea for frequent, long dialysis, let us remember that normal kidneys work 24 hours, 7 days a week, and that patients tend to do very well with a transplant—intuition would tell us that more dialysis is better. Although there may be some qualifications in that statement, I am convinced of a benefit for longer, more frequent dialysis. All of my dialysis patients commence on 5 hours per session three times per week, and all of my home dialysis patients use alternate-day scheduling, predominantly with 6 to 8 hours per (n) nocturnal) session. Increased hours and frequency are much easier in the home setting, and I am a strong advocate for this.

References

1. Tentori F, et al. Longer dialysis session length is associated with better intermediate outcomes and survival among patients on in-center three times per week hemodialysis: Results from the Dialysis Outcomes and Practice Patterns Study (DOPPS). Nephrol Dial Transplant 2012; 27:4180–4188.


Figure 1. Intradialytic and interdialytic patient concentrations in the plasmatic (C1; bold line) and extracellular (C2; thin line) compartments for a representative patient who was switched from reference dialysis (4 hours, three times per week) to six times per week 2-hour dialysis.