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REVIEW

Using more frequent haemodialysis to manage volume overload in dialysis patients with heart failure, obesity or pregnancy

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ABSTRACT

Managing dialysis in patients with heart failure, pregnancy or obesity is complex. More frequent haemodialysis 5–6 days/week in randomized clinical trials has shown benefits for controlling volume overload, blood pressure and phosphorus, reducing left ventricular hypertrophy (LVH), and improving patient tolerance to therapy. Therapy prescriptions were guided by volume of urea cleared, time-integrated fluid loading control and increased phosphate–β2 microglobulin removal, with greater treatment frequency to address clinical efficacy targets. Case studies in all three categories show that treatment with more frequent haemodialysis in low-dialysate flow systems (Qd <200 mL/min, dialysate of 25–30 L/session, 5–7 days/week for 2.5–3.0 h/session) improves control of heart failure. In pregnancy, treatment 7 days/week with 30 L and 3 h/session of dialysis enabled successful delivery of infants at 32–34 weeks, with all doing well 2–5 years after birth. Obese patients with a body mass index (BMI) >35 achieved control of volume, blood pressure and uraemic symptoms compared to their prior 3 times/week in-centre haemodialysis. Greater application of more frequent haemodialysis should be considered, particularly in high-risk populations, to improve clinical care.

Keywords: dialysis, haemodialysis, heart failure, obesity, pregnancy

INTRODUCTION

Managing persistent volume overload and instability during dialysis is a significant challenge, with concomitant symptomatic and asymptomatic intradialytic hypotension (IDH) that results in dialysis-induced myocardial ischaemia (cardiac stunning) and long patient recovery times [1–4]. Volume overload is present in ∼50% of haemodialysis (HD) patients, and in a similar percentage in the peritoneal dialysis (PD) population [5, 6], complicating cardiac reserve and patient tolerance to treatment [5, 6]. Symptomatic hypotension complicates up to 17% of all dialysis sessions, while asymptomatic IDH has been reported to complicate nearly 26% of dialysis sessions [7, 8]. The combination of volume overload and cardiac instability is particularly challenging to manage in patients with heart failure, during pregnancy and in obese patients on dialysis.

The Frequent Haemodialysis Network (FHN) randomized controlled trial of more frequent HD (5–6 days/week) versus conventional 3 times/week HD [9] showed significant improvements in blood pressure (BP) control with less medication, significant reductions in left ventricular mass index (LVMI) , improved phosphorus control with less medication, reduced hypotensive episodes on dialysis and reduced post-dialysis recovery time. A frequent nocturnal HD trial and the Culleton *et al.* Canadian Trial also showed similar findings of volume control, BP control and phosphate (PO_4) control with fewer medications [10, 11]. Volume loading between HD treatments (93% of the total weekly time off dialysis) was a significant predictor of outcomes under time averaged fluid loading, suggesting that frequent HD may be an important tool for improving cardiovascular outcomes in conversional HD patients [12]. Reducing ultrafiltration rates has also been suggested to improve patient outcomes [13]. Both volume unloading through control and reduction of ultrafiltration rate (UFR) and volume loading between treatments contribute to organ system stresses, magnified in those with heart failure, pregnancy or obesity.

The case studies in this review demonstrate how application of the approaches noted in the FHN and Nocturnal clinical trials of more frequent treatments 5–7 days/week, with ultrafiltration rates between 2 and 7 mL/kg/h and session times of 2.5–3.0 h, delivers greater phosphorus and β2 microglobulin removal than conventional 3 times/week in-centre HD. These approaches provide improved care in patients with severe heart failure or pregnancy [14] and achieve uraemia and BP control in obese patients >150 kg with a BMI >35.

HEART FAILURE WITH SEVERE FLUID OVERLOAD AND HYPOTENSION

Patient 1

Patient 1 is a 76-year-old, 71-kg female with renal failure due to glomerulonephritis, who received pre-emptive transplantation. The transplant failed because of vascular rejection, the patient developed post-transplant lymphoproliferative disease requiring chemotherapy and she commenced automated PD. The patient developed severe hypotension, dizziness and fluid overload and an echocardiogram showed an ejection fraction (EF) <20%, thought to be secondary to long-standing renal disease and previous chemotherapy; a coronary angiogram revealed normal coronary vessels. Patient 1 continued to suffer episodes of loss of consciousness; despite the insertion of a biventricular pacemaker, her EF remained <20%. Symptomatic fluid overload and hypotension continued to limit the use of angiotensin-converting enzyme (ACE) inhibitors inhibitors and β-blockers and were associated with limited mobility, breathlessness, oedema and very poor quality of life.

During this time, Patient 1 had eight separate hospital admissions relating to cardiac failure. In an attempt to achieve volume control, she was changed to HD 3 times/week, with no success. The patient, with her family's support and the assistance of a care partner, then initiated home training using a vascular catheter and a low-flow home dialysis system (NxStage System One, Lawrence, MA, USA), starting at four 3-h sessions/week and increasing to six. The UFR was kept to a maximum of 600 mL/h or <7.5 mL/kg/h. During the following weeks, 10 kg in weight was removed. The patient suffered no episodes of loss of consciousness, her BP stabilized and she reported fewer episodes of breathlessness and significant improvement in quality of life and mobility.

Patient 1 continued short frequent home HD for the next 30 months, with 5 sessions/week, and remained well, with no signs of fluid overload, very few episodes of symptomatic hypotension on dialysis and a target UFR on dialysis of 6 mL/kg/h. Repeat echocardiogram showed an EF of 35%. Table 1 shows echocardiographic data, dialysis prescription, medication and symptoms during this period.

Patient 2

Patient 2 is a 74-year-old, 67-kg woman who developed renal failure as a result of glomerulonephritis. After an initial renal transplant, she spent 6 months on PD before transferring to in-centre HD 3 times/week. This approach was significantly hampered by symptomatic hypotension, leading to difficulties removing fluid and a resultant chronically volume-loaded state. Echocardiography at this time showed an EF of 41% with significant pulmonary hypertension at 60 mmHg.

In conjunction with a care partner, the patient trained for home HD on a low-flow home dialysis system (NxStage System One). During the first few months it remained difficult to gain control of erratic BPs and fluid balance. Shortness of breath worsened and the patient developed significant ascites. Full investigations revealed no liver dysfunction, but ongoing pulmonary hypertension requiring paracentesis. More treatment time per session was added to the dialysis regimen, with adjustment of the UFR, which led to a significant improvement in BP control and symptoms and allowed the reintroduction of angiotensin receptor blocker (ARB) therapy. The patient has now been on frequent short daily home haemodialysis (HHD) for 2.5 h/session, 6 days/week, for 60 months, with a dramatic improvement in symptoms and normalization of pulmonary artery pressures. Her breathlessness and ascites have completely resolved and she has been discharged from the cardiac clinic. Table 2 summarizes the treatment course.

Patient 3

Patient 3 is a 53-year-old, 85-kg male with a history of hypertrophic obstructive cardiomyopathy, requiring cardiac ablation therapy and an implantable defibrillator. End-stage renal failure, due to glomerulonephritis, was initially treated with PD and then with renal transplantation. On failure of the transplant, the patient's initial return to PD was complicated by peritonitis and he was transferred to HD. The patient commenced 3 times/week in-centre dialysis, with sessions often complicated by hypotensive episodes. Cardiac function was known to be impaired, with an EF of 45% and moderate mitral regurgitation. The patient trained for home HD using a low-flow home dialysis system (NxStage System One) and commenced a regimen of six 2.5 h sessions/week with 25 L of dialysate. Symptoms improved on dialysis and exercise tolerance improved. The patient was then admitted to the hospital for surgery and suffered a cardiac event with prolonged preoperative hypotension. Cardiac function declined, with an EF of just 35%, and the patient became very symptomatic with breathlessness on minimal exertion. He was treated in the hospital, receiving 3 times/week HD. The patient felt very unwell and wanted to return to home dialysis, a decision supported by a care partner (Table 3 timeline). Dialysis was modified to 5 sessions/week for 3 h, with 30 L of dialysate. Over the next 6 months, his BP stabilized, an ARB was introduced to the drug regimen and breathlessness resolved. Coronary angiography showed no significant coronary disease

Table 1. Patient 1 treatment course for a 76-year-old female, 71 kg, with renal failure due to glomerulonephritis and with heart failure

Date	Echocardiographic data	Dialysis and cardiac medication	Symptoms
November 2014	EF < 20%	PD, Biventricular pacemaker	Blackout, SOB, 20 kg overloaded, mobility scooter
March 2015	EF 10%	ICHD, all meds stopped	Blacking out on HD, very low BP, increased overload
October 2015	EF 17.8%	4 times a week, small dose β-blocker (4 h, 40 L)	Not lowering BP, slowly reducing weight
February 2016	EF 31%	6 times a week at home, increase β-blocker (2.5 h, 20 L)	No oedema, maintaining BP, walking
June 2017	EF 35%	5 times a week at home (3 h, 30 L)	Improved mobility, stick only, not SOB

ICHD, in-center HD; SOB, shortness of breath.

Table 2. Patient 2 treatment course for a 74-year-old female, 67 kg, with renal failure due to glomerulonephritis and with heart failure, pulmonary hypertension and hypotension

Date	Echocardiographic data	Dialysis and cardiac medication	Symptoms
2014	EF 41%, PAP 60 with severe TR	ICHD 3 × 4 h/week ARB stopped; calcium channel antagonist stopped	Symptomatic hypotension Not tolerating UF
2015	EF 60%, PAP 77, moderate–to–severe TR	Frequent HHD, 6 × 2 h with 20 L	Development of significant ascites, significant SOB
2016	EF 55–65%, PAP 21, mild TR	Frequent HHD, 6 × 2 h 45 min, 25 L, reintroduction of ARB	Reduction in ascites, improvement in SOB
2019	EF 60–65%, normal PAP, trivial TR	Frequent HHD, 6 × 2.5 h. ARB and calcium channel antagonist	No ascites, no SOB, improved exercise tolerance

PAP, pulmonary artery pressure; TR, tricuspid regurgitation; SOB, shortness of breath.

Table 3. Patient 3 treatment course for a 53-year-old, 85-kg male with renal failure due to glomerulonephritis and a history of hypertrophic obstructive cardiomyopathy

Date	Echocardiographic data	Dialysis and cardiac medication	Symptoms
2015	EF 45–55% PAP 45 Moderate MR, hypertrophic obstructive cardiomyopathy	PD	Fluid overloaded
2016	EF 40–45% PAP > 55 Moderate–severe MR	Haemodialysis 3 × 4 h β-blocker	Hypotensive episodes on dialysis and SOB
2018 (February)	EF35% PAP38 Moderate–severe MR and TR	Perioperative cardiac event in hospital 3 times a week	Sever SOB, limited exercise tolerance
2018 (November)	EF 65%	Home HD 5 × 3 h, 30 LARB	Tolerating dialysis without issue Exercise improved Referred for renal transplant

SOB, shortness of breath.

and a repeat echocardiogram showed a significant improvement in cardiac function with an EF of 65%.

SUMMARY: HEART FAILURE WITH VOLUME OVERLOAD AND HYPOTENSION

These three cases demonstrate the impact of increasing the frequency of dialysis treatments to five to six times per week, providing increased volume control by reducing intertreatment cardiac loading. The increased total weekly dialysis time reduces the UFRs, thereby also reducing the potential for intratreatment hypotension and cardiac stunning. These treatment strategies to control volume constitute the dialysis adaptation to achieving volume control, whereas in the non-dialysis population, management is targeted at diuresis from diuretics with increased frequency throughout the day. The ultimate effectiveness of either treatment approach is control of cardiac congestion and PAPs with improved patient symptoms. The efficacy of frequent treatment was assessed by repeated monitoring of volume load by either bioimpedance spectroscopy or cardiac status with echocardiography, as is done in the non-dialysis heart failure population.

PREGNANCY CARE MANAGEMENT

The next series of cases focuses on pregnancy, a natural volume-loaded state in the normal population but a very difficult clinical situation with patients on dialysis. These cases should be viewed from the context of the known clinical benefits of more frequent nocturnal HD on pregnancy outcomes reported by the Toronto group, which dialysed 6 nights/ week, achieving superior outcomes compared with other dialysis pregnancy registry data from the USA [14].

Patient 2

Patient 2 had a child from a first marriage before being dialysed and desired a second pregnancy with her new husband. In December 2015, after the failure of *in vitro* fertilizations, she received an oocyte donation in Spain. After confirmed pregnancy, her dialysis dose was increased to 7 days/week for 150 min/session with a dialysate volume of 30 L. The weekly dialysis duration was 17 h with a stdK_t/V calculated at 3.43. Early hypertension was treated with methyldopa at 125 mg/day and careful UF control. The patient started spontaneous labour at 34 weeks and delivered, by caesarean section, a viable boy weighing 1.7 kg. She resumed short daily home HD 7 days after giving birth. Her son is now 3 years old and healthy and the patient continues to perform daily dialysis at home.

Patient 4

Patient 4 is a 35-year-old female with renal failure due to focal segmental glomerulosclerosis who started HD at the age of

Table 4. Patient 4 treatment course for a 35-year-old pregnant female patient with renal failure due to focal segmental glomerulosclerosis

Pregnancy period	Weight	Dialysis schedule	BP and medication
Before pregnancy	71 kg	Session duration: 125 min Weekly sessions: 5 Dialysate volume: 25 L/session	135/88 mmHg Methyldopa 1 g
M3	73 kg	Session duration: 150 min Weekly sessions: 7 Dialysate volume: 30 L/session	149/79 mmHg Methyldopa500 mg
M6	76 kg	Session duration: 150 min Weekly sessions: 7 Dialysate volume: 30 L/session	137/80 mmHg Methyldopa250 mg
M8 = delivery	79.5 kg	Session duration: 150 min Weekly sessions: 7 Dialysate volume: 30 L/session	137/94 mmHg Methyldopa250 mg
After pregnancy	77 kg	Session duration: 150 min Weekly sessions: 5 Dialysate volume: 30 L/session	150/100 mmHg Amlodipine 5 mg

Table 5. Patient 5 treatment course for a 44-year-old pregnant female with renal failure due to focal segmental glomerulosclerosis

Pregnancy period	Weight	Dialysis schedule	BP and medication
Before pregnancy	68 kg	Session duration: 125 min Weekly sessions: 5 Dialysate volume: 25 L/session	135/70 mmHg No antihypertensive treatment
M3	70 kg	Session duration: 150 min Weekly sessions: 7 Dialysate volume: 30 L/session	149/79 mmHg No antihypertensive treatment
M6	76 kg	Session duration: 150 min Weekly sessions: 7 Dialysate volume: 30 L/session	140/80 mmHg Methyldopa 125 mg
M8 = delivery	78 kg	Session duration: 150 min Weekly sessions: 7 Dialysate volume: 30 L/session	130/80 Methyldopa 125 mg
After pregnancy	77 kg	Session duration: 125 min Weekly sessions: 6 Dialysate volume: 25 L/session	125/71 mmHg No antihypertensive treatment

15 years and had two failed kidney transplantations, with recurrence of the initial glomerulopathy. In September 2012, she restarted dialysis after failure of the second transplantation (Table 4). Interested in pregnancy, she started intensive HD with 5 sessions/week and 25 L of dialysate >125 min per treatment on a low-flow home dialysis system (NxStage System One) using a fistula. She achieved a stdK_t/V of 2.1.

After a failed spontaneous pregnancy, in September 2014, she received intra-uterine insemination with inducted ovarian stimulation. After positive pregnancy tests, the number of dialysis sessions was increased to 7 days/week for 150 min with dialysate volume of 30 L/session. With this new dialysis schedule, the weekly dialysis duration was 17 h, resulting in a stdK_t/V of 4.44. Normal weight gain for pregnancy was noted at 10 kg and UF was between 1 and 1.5 L/session. BP was controlled, with methyldopa treatment dose decreasing during the pregnancy. Anaemia was treated with an erythropoiesis-stimulating agent, with a dose increase of 50% after 4 months of pregnancy. Regular obstetrics follow-up did not reveal any anomaly in the foetal weight.

At 33 weeks and 3 days the patient developed metrorrhagia. She delivered vaginally at 33 weeks and 5 days a viable girl measuring 39 cm and weighing 1.5 kg. The patient resumed the short daily home dialysis after 10 days of hospitalization.

Her daughter is now 5 years old and healthy and the patient performs daily dialysis at home.

Patient 5

Patient 5 is a 44-year-old female with renal failure from segmental glomerulosclerosis with cyclosporine resistance who was diagnosed at 35 years of age. Her first kidney transplant failed due to early recurrence of glomerulopathy and in July 2013 she restarted in-centre HD. The patient then went to home treatment and trained on a low-flow home dialysis system (NxStage System One) in September 2013. Her initial prescription was 5 sessions/week with 25 L of dialysate for 125 min using a fistula (Table 5).

Patient 6

Patient 6 is a 27-year-old female with no known medical history who developed end-stage kidney disease (ESKD) at 6 weeks of pregnancy. Her estimated glomerular filtration rate was 10 mL/min and it was decided to start HD. Home HD was chosen and a fistula was created after 9 weeks of pregnancy. The first HD session was performed after 14 weeks of pregnancy, with the patient starting home training leading to home therapy by 22 weeks.

Short frequent HD was prescribed at 7 sessions/week with 30 L of dialysate for 150 min on a low-flow home dialysis system (NxStage System One) using a fistula (Table 6). The pregnancy proceeded without any complications. She delivered a healthy boy weighing 1.9 kg after 32 weeks and 2 days of pregnancy.

Post-partum, the patient was found to have severe heart failure caused by genetic cardiomyopathy. After a long stay in the cardiology unit, she resumed short daily home HD 2 months after giving birth.

Her son is now 2 years old and healthy. The patient continued daily dialysis until receiving a kidney transplant 18 months after her delivery.

SUMMARY OF MORE FREQUENT HD AND PREGNANCY

These three cases demonstrate that pregnancy in the dialysis population can be successfully managed with 7 days/week therapy for 2.5–3.0 h/session and 30 L of dialysate per treatment, yielding live births at 32–34 weeks of gestation and birth weights of 1.5–1.9 kg. All children are developing normally at 2–5 years of follow-up. These results are consistent

with the Toronto group's experience, which showed reasonable BP control and foetal growth, and with the Kidney Disease: Improving Global Outcomes (KDIGO) practice guidelines on management of pregnancy [15, 16].

TREATING OBESE PATIENTS WITH MORE FREQUENT HD

The challenge in treating very large patients with any form of dialysis, let alone in-centre HD, is providing a therapy prescription that will address uraemic symptoms, adequate small and middle molecule removal and a reasonable, tolerable treatment time per session. The typical schedule of three 4-h treatments is too low to reach reasonable weekly desired therapy targets. Using estimates of total body water and targeted weekly stdK_t/V of 2.3, treatment times are typically 5–5.5 h/session 3 days/week. This type of schedule is poorly accepted. The cases below show how more frequent home HD delivered 6–7 days/week with a low-flow dialysate delivery system yields excellent clinical results with reduced daily time commitments but added sessions per week, achieving not only good small solute clearances but—because of the high saturation rates—excellent middle and larger molecule removal [17–19].

Table 6. Patient 6 treatment course for a 27-year-old pregnant female who developed ESKD at 6 weeks of pregnancy

Pregnancy period	Weight	Dialysis schedule	Symptoms, BP and medication
Before pregnancy	68 kg	No dialysis	No treatment No symptom
M3	68 kg	No dialysis Créatinine 430 µmol/L Glomerular filtration rate (GFR) = 11 mL/min	130/90 mmHg No antihypertensive drug
M6 = training for home daily HD	76 kg	Session duration: 150 min Weekly sessions: 6 Dialysate volume: 30 L/session	128/94 mmHg No antihypertensive
M8 = delivery	78 kg	Session duration: 150 min Weekly sessions: 7 Dialysate volume: 30 L/session	137/94 mmHg No antihypertensive drug
2 months after pregnancy	70 kg	Session duration: 150 min Weekly sessions: 5 Dialysate volume: 30 L/session	100/62 mmHg Bisoprolol for heart indication

Patient 7

Patient 7 is a 34-year-old man with ESKD from segmental glomerulosclerosis who started in-centre dialysis in May 2014. At a weight of 200 kg and a height of 1.9 m, his BMI was 54.2 kg/m^2. During the first 3 years of dialysis he received therapy for 5 h 3 days/week, for a total of 15 h/week (Table 7). With this standard dialysis schedule, he had symptoms of severe restless legs that disrupted his sleep, persistent weakness all the time and pain in multiple joints. Because of these many symptoms, he has stopped working.

The patient wanted to change his dialysis modality in order to improve his quality of life. He started training for daily dialysis with a low-flow home dialysis system (NxStage System One). The therapy prescription was challenging, as we needed to determine the desired dialysate volume in order to figure out the per-session dialysate needed. Using the Watson equation, the volume of water was estimated at 87 L; with a bioimpedance analysis (Body Composition Monitor; Fresenius Medical Care, Bad Homburg, Germany), however, measurement of the total body water was 71 L. The initial dialysis prescription was 6 sessions/week with 30 L of dialysate for 150 min with a blood flow set at 450 mL/min.

After 4 weeks of follow-up, the patient's restless leg symptoms disappeared and he had less fatigue. After 2 months, his mobility improved and he returned to work. After 6 months, his joint pain had decreased. Biological parameters improve as early as Week 4: pre-dialysis basal urea and β2-microglobulin decreased (38–23 mmol/L and 21.4–15.3 mg/L, respectively), while albuminaemia increased from 35.9 to 45.6 g/L. Phosphoraemia was stable and phosphate binders were unchanged. The patient has now used a fistula daily for 2 years with the buttonhole technique and has had no complications.

Patient 8

Patient 8 is a 40-year-old man who developed renal failure from chronic glomerulonephritis and had a history of familial cardiomyopathy requiring an implantable defibrillator. He is obese, weighing 110 kg and measuring 1.75 m in height, corresponding to a BMI of 36 kg/m^2. He was initially treated with

Table 7. Patient 7 treatment course for a 34-year-old male patient, weight 200 kg, with ESKD from segmental glomerulosclerosis

Date	Symptoms	Dialysis and cardiac medication	Biological parameters
December 2016	Restless legs syndrome Weakness Joint pain No job	In-centre HD 3 sessions/week 15 h/week	Predialysis BUN: 38 mmol/L Albumin: 35 g/L Phosphorus: 1.6 mmol/L β2-microglobulin: 23 mg/L
February 2017		Home HD training	
August 2017	No joint pain No restless syndrome Weakness decrease Find a new job	Home dialysis Session duration: 150 min Weekly sessions: 6 Dialysate volume: 30 L/session	Predialysis BUN: 23 mmol/L Albumin: 45 g/L Phosphates: 1.9 mmol/L β2-microglobulin: 15.3 mg/L

BUN, blood urea nitrogen.

PD, but the therapy was insufficient to treat the water overload and manage his cardiomyopathy.

In May 2012, the patient's therapy was changed to in-centre HD. During the first 6 months he received 3 sessions of therapy per week, often complicated by episodes of symptomatic hypotension. Because of these episodes, he was changed to short daily in-centre dialysis, resulting in better dialysis tolerance. Living far from the dialysis centre, he spent a great deal of time traveling and therefore chose home HD.

In May 2014, the patient trained for home HD using a low-flow home dialysis system (NxStage System One) and commenced a regimen of six 2.5-h sessions/week with 25 L of dialysate. The patient's quality of life improved such that he could share lunch every noon with his two children. Because of his loss of residual renal function, in May 2015 the regime was changed to six 2.5-h sessions/week with 30 L. The patient's single-pool K_t/V increased to 0.6/session and his weekly stdK_t/V increased to 2.5.

During the patient's entire follow-up on home HD he returned only once to in-centre dialysis because of a vascular access issue. Unfortunately, his heart function suddenly deteriorated and he died in August 2017 before his scheduled double kidney and heart transplant.

This last case demonstrates the combined challenge of treating severe heart failure in a moderately obese person.

DISCUSSION

Patients with heart failure, pregnancy and obesity represent practical applications of the clinical trial data on more frequent dialysis and demonstrate controlled fluid removal and BP and improved patient symptoms [10, 12, 20, 21]. The heart failure group exemplifies the cardiac pressure patterns demonstrated in the decompensated heart failure studies in the general population, with the schedule of 5–6 treatments/week analogous to the fluid control guided by PAP monitoring [11, 22, 23]. Treatment and control in pregnant patients are similar to those noted with frequent nocturnal HD, as shown by the Toronto group, once again controlling volume loading and uraemic toxin removal [15]. And results in the obesity group showed how frequent HD in the home setting can reduce the burden of long in-centre HD treatment times 3 days/week, adapting therapy to shorter, more frequent treatments at home.

There are important limitations to these cases, as they do not represent randomized clinical trials but rather practice applications of established trial findings. There are no established criteria for which patients may be the best candidates for more frequent HD in the home setting. While these cases used 5–6 treatments/week, and 7 treatments/week in pregnancy, there are no trial data to assess other schedules such as every other day or 4 days/week. Clinical judgement was used to apply the frequency based on known trial data, with the results being consistent with those findings. Additional studies are needed to define the best match between clinical conditions and the frequency needed to improve patient care and well-being.

In summary, patients with severe heart failure, pregnancy or obesity can be successfully treated with more frequent HD in the home setting with 5–7 treatments/week and treatment times of 2.5–3.0 h/session with a low-flow dialysate system. Greater experience with more frequent HD is needed to help determine whether alternative schedules of 3.5 or 4 treatments/week achieve the clinical efficacy noted in these cases and in the clinical trials. Until such time, the current clinical trial efficacy data tested on frequencies of 5–6 times/week and 7 days/week in pregnancy appear to be effective in targeted populations.

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CONFLICT OF INTEREST STATEMENT

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