RESEARCH LETTER

Feasibility of Twice-Weekly Hemodialysis: Contingency Planning for COVID-19

To the Editor:

Patients receiving facility-based hemodialysis represent a unique and vulnerable population during the coronavirus disease 2019 (COVID-19) pandemic. These individuals require life-sustaining treatment on average 3 times weekly at a dialysis center and cannot remain isolated at home. For each treatment, patients regularly interact with transportation workers, other dialysis patients, and members of the health care team. This places them at heightened risk for acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection. Furthermore, potential shortages of hemodialysis staffing and/or supplies (ie, from illness, quarantine, and markedly increased numbers of patients requiring acute dialysis for acute kidney injury) have been acknowledged as a significant risk to continued adequate delivery of facility-based hemodialysis care during the pandemic.[1,2]

As part of contingency planning for lowering coronavirus transmission and/or the potential scenario of fixed/reduced resources during the COVID-19 pandemic, the strategy of reducing hemodialysis treatments from 3 times weekly to twice weekly has received international attention.[1-3] A twice-weekly hemodialysis strategy extrapolates from research efforts evaluating incremental hemodialysis, including prior observational studies from the United States and China.[4-7] These studies concluded a twice-weekly hemodialysis prescription as noninferior to thrice-weekly treatment in select patients with preserved residual kidney function, with minimal interdialytic weight gain, and without hyperkalemia or marked comorbidity.

In Nova Scotia, Canada, patients receiving facility-based hemodialysis in affiliation with the province's largest tertiary-care center were assessed for candidacy for twice-weekly treatment as part of contingency planning for the potential scenario of fixed/reduced resources in accordance with national Canadian guidelines for the management of outpatient hemodialysis during the pandemic.[1] The Nova Scotia Health Authority Renal Program provides kidney replacement therapy to

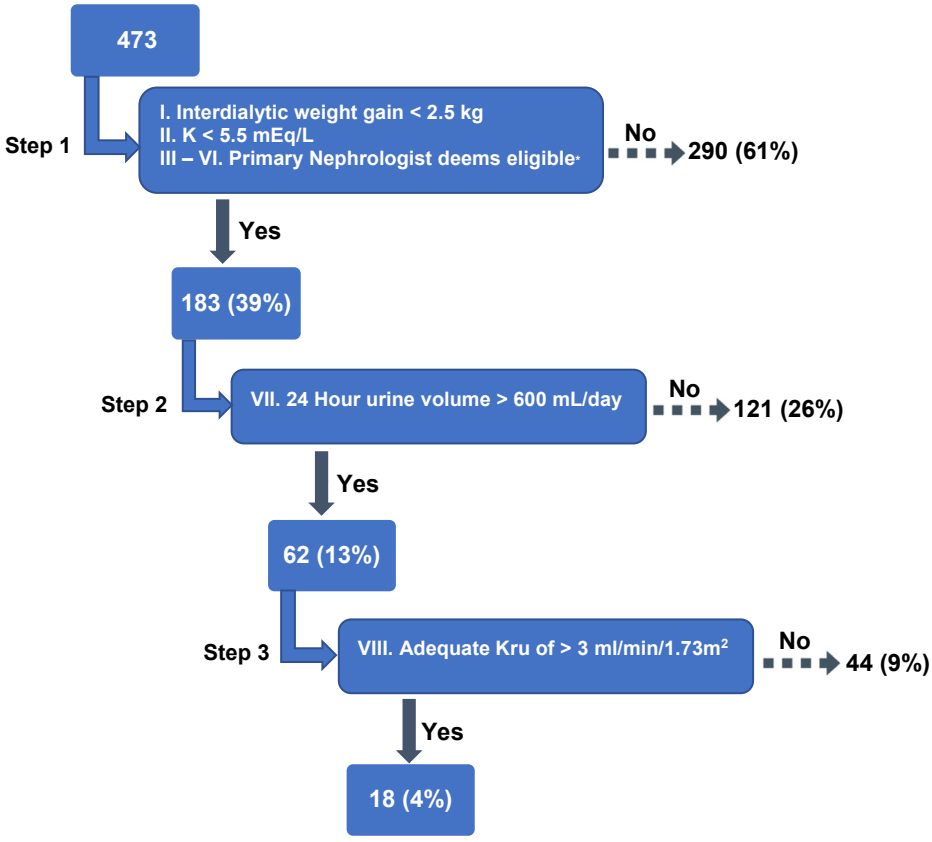

Figure 1. Stepwise approach and selection criteria[5-7] to review all facility-based hemodialysis patients for candidacy for twice-weekly hemodialysis (N = 473). *Patients who fulfilled interdialytic fluid gain and serum potassium criteria were assessed by their primary nephrologist for eligibility using each of: III, good nutritional status; IV, no clinical evidence of fluid overload; and V/VI, infrequent hospitalization/easily manageable comorbid conditions (cardiovascular and pulmonary). Abbreviation: Kru, residual urea clearance.

Table 1. Characteristics of Patients Who Meet Criteria for Twice-Weekly Hemodialysis

Variable	N = 18
Age, y	63 ± 12
Male sex	13 (72%)
White race	17 (95%)
Has diabetes	11 (61%)
Body mass index, kg/m^2	29 ± 5
Elapsed time on dialysis	
<6 mo	6 (33%)
6-12 mo	3 (17%)
>12 mo	9 (50%)
HD prescription	
3.5 h 3×/wk	7 (39%)
4 h 3×/wk	11 (61%)
Dialysate potassium bath	
2K	4 (22%)
3K	13 (72%)
4K	1 (6%)
Access	
Central venous catheter	16 (89%)
Arteriovenous fistula	2 (11%)
Compliance[a]	
0 missed treatments	15 (83%)
1 missed treatment	3 (17%)
>1 missed treatments	0 (0%)
Laboratory values[b]	
Serum albumin, g/L	36 ± 4
Serum potassium, mEq/L	4.6 ± 0.4
Serum hemoglobin, g/L	109 ± 13
Urea reduction ratio, %	72 ± 7
Pre-HD systolic/diastolic BP,[c] mm Hg	152 ± 16/70 ± 9
Post-HD systolic/diastolic BP,[c] mm Hg	142 ± 20/66 ± 17
Kru, mL/min/1.73 m^2	5.7 ± 2.7

Note: Values expressed as mean ± standard deviation or number (percent).
Abbreviations: BP, blood pressure; HD, hemodialysis; Kru, residual urea clearance.
[a]Considered all sessions from 4 weeks preceding twice-weekly assessment.
[b]Values from routine testing within 6-week period before twice-weekly assessment.
[c]Average of values from 3 preceding sessions before twice-weekly assessment.

individuals from a catchment area of more than 750,000 individuals. In April 2020, a rapid systematic review of all prevalent patients receiving at least thrice-weekly hemodialysis was performed, using a stepwise approach to apply key selection criteria (adapted from previously studied criteria[5-7]) for twice-weekly hemodialysis eligibility (Fig 1; further details of the stepwise approach are available in Item S1). Characteristics of patients who fulfilled twice-weekly criteria were reported using univariable statistics.

Of 473 patients assessed in a 3-week period, only 18 (4%) fulfilled criteria for twice-weekly hemodialysis (Fig 1). Of these patients, average age was 63 ± 12 (SD) years, average body mass index was 29 ± 5 kg/m^2, 61% had diabetes, 95% were White; and at least 67% were receiving dialysis for 6-plus months before assessment (Table 1). Fifteen (83%) eligible patients missed 0 treatment in the preceding month, and none missed more than 1 treatment. Average serum albumin level was 36 ± 4 g/L; urea reduction ratio, 72.7; and residual urea clearance, 5.7 ± 2.7 mL/min/1.73 m^2 (no patient's predialysis serum urea values demonstrated >10% variability in the preceding 3 months).

Our stepwise approach for the assessment of twice-weekly hemodialysis eligibility permitted a rapid evidence-based assessment for contingency planning purposes. Although feasible, a twice-weekly hemodialysis strategy could be applied to only a small proportion of our patient population, a finding that coincides with similarly low reported rates of twice-weekly hemodialysis patients in the United States.[8] This common pattern reinforces the notion that a higher percentage of North Americans may be precluded from twice-weekly eligibility due to a concurrent higher burden of comorbid diseases as compared with patients from other countries (ie, China) in which twice-weekly hemodialysis is more common.[9] Furthermore, the "intention to defer" strategy for initiating patients on dialysis in Canada[10] may also partly explain the lower rate of eligibility observed at our center, assuming fewer hemodialysis patients with sufficient residual kidney function to qualify.

Although we recognize the utility of twice-weekly hemodialysis in lowering coronavirus transmission and/or mitigating challenges caused by the potential scenario of fixed/reduced resources,[2] our findings suggest that alternative contingency strategies need to be explored, a conclusion that extends to other Canadian centers if results to our strategy are generalized nationally. Recognizing that the inclusion criteria for twice-weekly hemodialysis eligibility were adapted into our stepwise approach and repurposed for contingency planning, if criteria for residual kidney function were relaxed, eligibility for twice-weekly hemodialysis would be higher, approximating 40% of patients. Of note, these patients still met inclusion criteria addressing hypervolemia, hyperkalemia, and multimorbidity, all major issues of concern for patients reducing from thrice- to twice-weekly hemodialysis in a recently published counterpoint report arguing against the use of twice-weekly hemodialysis in times of dialysis unit stress.[9] However, it is important to acknowledge the limited number of studies and available data to date evaluating outcomes of twice-weekly versus thrice-weekly hemodialysis.[9] Therefore, we concur that a twice-weekly strategy be implemented only as an option of last resort.[1,9] Because future adversity resulting in dialysis unit stress is inevitable (ie, natural disasters), we suggest that our rapid assessment approach be validated across other centers to inform the applicability of this contingency option.

SUPPLEMENTARY MATERIAL

Supplementary File (PDF)

Item S1: Detailed methods

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Authors' Contributions: All authors contributed equally to each of research idea, data acquisition, data analysis/interpretation, and statistical analysis. Each author contributed important intellectual content during manuscript drafting or revision and agrees to be personally accountable for the individual's own contributions and to ensure that questions pertaining to the accuracy or integrity of any portion of the work are appropriately investigated and resolved, including with documentation in the literature if appropriate.

Support: None.

Financial Disclosure: The authors declare that they have no relevant financial interests.

Peer Review: Received July 8, 2020. Evaluated by 1 external peer reviewer, with direct editorial input from the Editor-in-Chief. Accepted in revised form December 20, 2020.

 Published online February 5, 2021 with doi 10.1016/j.xkme.2020.12.005

REFERENCES

1. Suri RS, Antonsen JE, Banks CA, et al. Management of outpatient hemodialysis during the COVID-19 pandemic: recommendations from the Canadian Society of Nephrology COVID-19 Rapid Response Team. *Can J Kidney Health Dis*. 2020;7. 2054358120938564.
2. Meyer TW, Hostetter TH, Watnick S. Twice-weekly hemodialysis is an option for many patients in times of dialysis unit stress. *J Am Soc Nephrol*. 2020;31(6):1141-1142.
3. National Institute for Health and Care Excellence. COVID-19 rapid guideline: dialysis service delivery. https://www.nice.org.uk/guidance/ng160. Accessed June 20, 2020.
4. Bieber B, Qian J, Anand S, et al. Two-times weekly hemodialysis in China: frequency, associated patient and treatment characteristics and quality of life in the China Dialysis Outcomes and Practice Patterns study. *Nephrol Dial Transplant*. 2014;29(9):1770-1777.
5. Kalantar-Zadeh K, Unruh M, Zager PG, et al. Twice-weekly and incremental hemodialysis treatment for initiation of kidney replacement therapy. *Am J Kidney Dis*. 2014;64(2):181-186.
6. Obi Y, Streja E, Rhee CM, et al. Incremental hemodialysis, residual kidney function, and mortality risk in incident dialysis patients: a cohort study. *Am J Kidney Dis*. 2016;68(2):256-265.
7. Rhee CM, Ghahremani-Ghajar M, Obi Y, Kalantar-Zadeh K. Incremental and infrequent hemodialysis: a new paradigm for both dialysis initiation and conservative management. *Panminerva Med*. 2017;59(2):188-196.
8. Kuttykrishnan S, Kalanter-Zadeh K, Arah OA, et al. Predictors of treatment with dialysis modalities in observational studies for comparative effectiveness research. *Nephrol Dial Transplant*. 2015;30(7):1208-1217.
9. Mehrotra R. Counterpoint: twice-weekly hemodialysis should be an approach of last resort even in times of dialysis unit stress. *J Am Soc Nephrol*. 2020;31(6):1143-1144.
10. Nesrallah GE, Mustafa RA, Clark WF, et al. Canadian Society of Nephrology 2014 clinical practice guideline for timing the initiation of chronic dialysis. *CMAJ*. 2014;186(2):112-117.