Comparison of Longer and Shorter Hemodialysis Duration on Nutritional Status and Quality of Life of Hemodialysis Patients

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ABSTRACT

***Background:** Important determinants of dialysis adequacy are blood flow rate (BFR) and dialysis time. This study aimed to evaluate the impact of BFR and duration of dialysis session on nutritional status and quality of life (QoL) in hemodialysis (HD) patients. **Methods:** Real-world evidence studies (RWE) of 3 HD units that differ in BFR and/or dialysis time. Group I, HD 5 hours and BFR 200-250 mL/minute; group II, HD 4 hours and BFR 270-320 mL/minute, and group III, HD 4 hours and BFR 200-250 mL/minute. All HD units use the same dialysate flow and dialysis frequency. The 3-point Subjective Global Assessment (SGA) scale is used to assess nutritional status, while QOL is assessed using the SF-36. **Results:** There were 291 chronic HD patients with an average age of 51 (12.3) years, 50.5% were male. The proportion of SGA classes between groups did not differ significantly. Group I was associated with significantly higher PF and RP domain scores of PC and VT domain scores of MC compared to Group III. On the other hand, Group II was associated with significantly lower VT and MH domain scores of MC compared to Group I, while the other domains were not significantly different. In general, Group III had the lowest SF-36 scores compared to the other 2 groups. **Conclusion:** Duration of HD was not associated with nutritional status. Compared with 4-hour HD but with a faster BFR, 5-hour HD was associated with higher Mental Component QOL scores, but not Physical Component scores.*

***Keywords:** subjective global assessment, SF-36 questionnaire, blood flow rate, dialysis time.*

INTRODUCTION

The target of hemodialysis (HD) therapy in all patients is to achieve the best quality of life (QoL) for patients. To achieve this target, of course, requires a good HD, which is generally known as adequate dialysis. To assess the adequacy of dialysis, it can be assessed based on the laboratory by measuring URR and/or Kt/V, or assessed based on clinical assessment. Dialysis adequacy reflects the efficacy of HD and correlates well with nutritional status.[1] On the other hand, nutritional status is an important indicator of achieving QoL.[2] Malnutrition is associated with increased morbidity, decreased functional capacity, and longer duration of hospitalization, all of which can lead to a lower health-related quality of life (HR-QOL) and impact on patients' emotional, physical, mental, and psychosocial health. The main measure of dialysis adequacy based on the NKF-KDOQI identification is urea clearance.[3] For HD 3 times per week, the minimum acceptable urea removal target is a single-pool Kt/V of 1.2 or a percent urea reduction (PRU) of 65%.[4]

The increase in urea clearance, and possibly the adequacy of dialysis, is affected by many factors, including blood flow rate (BFR)[5,6], dialysis time, dialysis frequency[7], and dialysate flow rate (DFR).[8] Due to economic factors and patient intolerance to long periods of HD, increasing the duration of dialysis is not always possible, although it is an important method of increasing Kt/V. For low- and lower-middle-income countries (LMIC), the method of achieving adequate dialysis that appears to be the most rational option is to increase the BFR.[9] However, until now, there are no guidelines regarding the optimal BFR to increase urea clearance and otherwise not harm the patient. It is proven that there is a relationship between BFR and Kt/V; the faster the BFR, the Kt/V also increases.[5] To achieve a minimum adequate HD that meets the KDOQI guidelines, the BFR values are 320 mL/minute and 380 mL/minute. However, only the faster BFRs were able to meet the KDOQI Kt/V 1.4 and 70% URR targets, while the slower BFRs only met the URR targets. Statistically, there is a significant correlation between BFR and URR with Kt/V, if BFR increases, then Kt/V and URR also increase.[10]

In daily practice, HD implementation in Indonesia still has many variations, especially in terms of duration per HD session and/or rate of blood flow. Similarly, the duration of HD therapy and the frequency of HD also vary widely across the world. The most common HD prescription worldwide is 3-5 hours, 3 days per week.[11] HD therapy is associated with a high-cost burden, so for LMIC such as Indonesia, it is very important to determine the duration of HD and the rate of blood flow that provides the most optimal outcome. On that basis, we wanted to get real data for the implementation of HD therapy by evaluating the nutritional status and QoL of patients. This study aimed to evaluate the impact of BFR and duration of dialysis sessions on nutritional status and quality of life, and the relationship between these two outcomes in maintenance HD (MHD) patients.

METHODS

Subjects participating in this study were end-stage renal disease (ESRD) patients who underwent regular HD at 3 hospitals that differed in the policy of determining BFR and/or dialysis duration, as we did in our previous study.[9] The inclusion criteria were patients aged 18 years or over when they first underwent HD, patients who had undergone HD therapy for at least 3 months, HD sessions were carried out 2 times per week, had a good cardiovascular condition, in the last 3 months, had not moved to another HD unit, and had good vascular access. All patients provided written informed consent before inclusion. After obtaining informed consent to participate in this study, we enrolled a total of 291 participating patients. This study has received approval from the local ethics committee with IRB number 400/281/K.3/102.7/2022.

Study Design

This study uses the same design as our previous study.[9] This is an RWE study with the independent variable Quick blood (Qb) or BFR in units of mL/minute and duration of dialysis in hours. The dependent variables are the 3-point Subjective Global Assessment (SGA) and the 36-Short Form Health Survey. Subjects who participated in this study and met the inclusion criteria were grouped based on their daily HD program, which corresponds to the pattern of HD for each hospital. In the case of using dialyzer membranes (i.e., Nipro ELISIO™ 13 H), dialysis machines (i.e., Nipro Surdial 55 Plus, Nipro Medical (Hefei) Co., LTD-China), dialysate flow rates (i.e., 500 mL/min), dialysate composition, needles (16 -gauge), and the frequency of dialysis therapy (i.e., twice a week) were the same for each HD unit. Patients undergoing 5 hours of HD with BFR 200-250 mL/minute as group I, patients undergoing 4 hours of HD with BFR 270-320 mL/minute as group II, and patients undergoing 4 hours of HD with BFR 200-250 mL/minute as group III. Recording of age, sex, and causes of ESRD; as well as recording clinical data based on medical records, including average weight gain, blood transfusions, and use of antihypertensive drugs at least in the last 3 months.

Nutritional assessment. Assessment of nutritional status was carried out during visits to patients using a 3-point SGA scale. The assessment was carried out by 2 trained and experienced kidney nurses using a structured evaluation form. The patient was assessed in the previous six months for a history of changes in body weight, food intake changes, symptoms of gastrointestinal (nausea, vomiting, loss of appetite, and diarrhea), loss of subcutaneous fat mass, muscle wasting, changes in functional capacity, edema, and ascites. Between observers obtained an agreement (kappa coefficient) of 0.84. Furthermore, based on differences in nutritional status, patients were categorized into three classes, namely SGA class A (for good nutritional status), SGA class B (for undernutrition, mild to moderate malnourished), and SGA class C (for severe malnutrition), which is in accordance with Detsky et al. (1987.[12]

Quality of life. QOL was measured using the 36-Item Short Form Health Survey (SF-36). It is organized into eight dimensions: physical functioning (PF), role-physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role-emotional (RE), and mental health (MH). Each question is numerically coded and then scored on a scale of 0 (indicating the worst QoL) to 100 (indicating the best QoL). To calculate the sf-36 score, we use Ortho Toolkit.[13] Furthermore, these domains can be further aggregated into a physical component (PC) and a mental component (MC). The PC contained PF, RP, BP, and GH; the MC consisted of VT, SF, RE, and MH. Higher scores indicate better health status, and a mean score of 50 has been articulated as a normative value for all scales. The Cronbach's alpha coefficient based on a previous study was 0.842.

Statistical analysis.

Presentation of data adapted to the type of data. For continuous variables, they are presented as the mean (SD), while categorical variables are presented as percentages. Test for differences between variables using the independent t-test or the Mann-Whitney test, which is appropriate for both independent variables. For more than two independent variables, use the Kruskal-Wallis test followed by the Mann-Whitney test or one-way ANOVA test, followed by a post hoc test using the least significant difference (LSD). All data processing uses Statistical Product and Service Solution software, IBM SPSS Statistics 20, with a significance level of 0.05 (α=0.05).

RESULTS

Patient characteristics

This study involved 291 HD patients as participants. The mean age of the patients was 51 (12.3) years, and 50.5% were male. Diabetes accounted for about 27.5% of the total causes of ESRD, while in group III the proportion of diabetes was significantly higher than in other groups ($p<0.001$). It was found that the duration of dialysis was significantly longer in group I compared to group III, whereas compared to group II, there was no difference. In group II, AV fistula access was significantly more frequent. On the other hand, in group III, catheter access was significantly more frequent. Compared to the other 2 groups, the use of antihypertensive drugs was significantly higher in group III. In group I, the use of ESAs was the lowest compared to other groups, but the need for blood transfusions was also less (**Table 1**). The majority of patients in this study had good nutritional status (the proportion of SGA class A was 66.7%), while patients with mild to moderate malnutrition or SGA class B were 29.2%, and poor nutritional status was 4% (SGA class C) (**Table 2**). Likewise, most of the patients in this study had a mean SF-36 score > 50 in all domains, except for the RP and RE domains (**Table 3**).

Comparison of nutritional status and quality of life by treatment group.

There was no difference in the proportion of SGA class A between treatment groups. However, in group III, the lowest score was obtained, but the difference was not statistically significant. Likewise, the proportion of SGA class B, the highest score was obtained in group III, but there was no significant difference between the groups (Table 2). The SF-36 scores were significantly different between group I and group II in 2 domains of the mental component (MC), namely the VT and MH domains, while in the SF and RE domains, there was no difference. Likewise, in the physical component (PH), there was no difference between groups I and II in all domains (Table 3). On the other hand, there were significant differences between group III and group I in the physical component (PC) in the PF and RP domains and the mental component (MC) in the VT and MH domains. In general, the SF-36 score in group III was lower than in group II, but from 8 domains, only significant differences were found in the PF domain (**Table 3**).

Table 1. Patient characteristics based on treatment group

Characteristic	Total (n=291)	Group			p-value
		I (n = 139)	II (n = 105)	III (n= 47)	
Age (yr), mean (SD)	51 (12.3)	51 (12.4)	51 (12.2)	53 (12.3)	0.479***
Age ≥ 65 yr (n, %)	39 (13.4)	17 (12.2)	14 (13.3)	8 (17)	0.596*
Male sex (n, %)	147 (50.5)	85 (61.2)[a]	42 (40)[b]	20 (42.6)[b]	**0.002***
Duration of dialysis, mon, median (range)	36 (3-268)	36 (3-268)[a]	36 (8-156)[a,b]	17 (3-91)[b]	**<0.001****
Access type (n, %)					
AV fistula	196 (67.4)	90 (64.7)	81 (77.1)	25 (53.2)	**0.010***
Catheter	47 (13.1)	28 (20.1)	8 (7.6)	19 (40.4)	**<0.001***
Others	48 (19.5)	21 (15.1)	16 (15.2)	3 (6.4)	0.082*
Mean IDWG (kg)	1.98 (0.88)	1.99 (1.04)	1.89 (0.63)	2.16 (0.87)	0.242***
Cause of ESRD (n, %)					
Diabetes	80 (27.5)	35 (25.2)	19 (18.1)	26 (55.4)	
Non-diabetes	211 (72.5)	104 (74.8)	86 (81.9)	21 (44.7)	**<0.001***
Using anti-hypertensive drug (n, %)					
Yes	177 (60.8)	90 (64.7)	48 (45.7)	39 (83)	**<0.001***
No	114 (39.2)	49 (35.3)	57 (54.1)	8 (17)	
Using ESA (n, %)					
Yes	216 (74.2)	89 (64)	94 (89.5)	33 (70.2)	
No	75 (25.8)	50 (36)	11 (10.5)	14 (29.8)	**<0.001***
Blood Transfusion (n, %)					
Yes	70 (24)	22 (15.8)	33 (31.4)	15 (31.9)	
No	221 (76)	117 (84.2)	72 (68.6)	32 (68.1)	0.012*

Data as mean (SD) or number (%). Significant values are in bold. * Chi-square test; ** Kruskal Wallis test followed by Mann Whitney U test; ***one-way ANOVA. a and b show a significant difference (p<0.05). ESRD, end-stage renal disease; ESA, Erythropoiesis-stimulating agents; AV, arteriovenous; IDWG, Interdialytic weight gain.

Table 2. Comparison of SGA class scores according to the therapy group.

SGA Class	The amount, (n=291)	Group			p-value
		I (n= 139)	II (n=105)	III (n=47)	
Class A	194 (77.7)	95 (68.34)	72 (68.57)	27 (57.45)	0.342
Class B	85 (29.2)	40 (28.78)	26 (24.76)	19 (40.04)	0.144
Class C	12 (4.1)	4 (0.03)	7 (0.07)	1 (0.02)	0.255

Data as a number (%). Chi-square test. BFR, blood flow rate; SGA, subjective global assessment; HD, hemodialysis

Table 3. Comparison of mean SF-36 domain scores according to the therapy group

SF-36 Domain, score (SD)	Score (SD)	Group			p-value
		I (n= 139)	II (n= 105)	III (n=47)	
Physical Component (PC)					
Physical functioning (PF)	60 (31)	63 (31) [a]	62 (33) [a]	46 (24) [b]	0.001**
Role-physical (RP)	36 (42)	41 (44) [a]	37 (40) [a,b]	20 (34) [b]	**0.020****
Bodily Pain (BP)	79 (23)	81 (23)	79 (24)	73 (19)	0.070***
General Health (GH)	54 (15)	54 (14)	55 (16)	52 (16)	0.409***
Mental Component (MC)					
Vitality (VT)	61 (26)	70 (46) [a]	53 (24) [b]	57 (19) [b]	**<0.001*****
Social functioning (SF)	79 (25)	83 (22) [a]	78 (25) [a,b]	70 (25) [b]	**0.007*****
Role-emotional (RE)	41 (44)	47 (46)	39 (43)	29 (39)	0.052**
Mental Health (MH)	71 (22)	77 (23) [a]	65 (21) [b]	69 (17) [a,b]	<0.001***

Data as mean (SD) or number (%). Significant values are in bold. ** Kruskal-Wallis test followed by Mann-Whitney test; ***one-way ANOVA test. a and b show a significant difference (p<0.05). The score ranges from 0 - 100, with a higher score indicating better QOL. ESRD, end-stage renal disease; ESA, Erythropoiesis-stimulating agents; AV, arteriovenous; IDWG, Interdialytic weight gain.

DISCUSSION

This is a real-world evidence (RWE) study that aims to determine the effect of BFR and duration of HD sessions (treatment time) on nutritional status and QoL in patients with MHD. As in our previous study[9]In this study, we used the SGA questionnaire to assess nutritional status and the 36-Item Short Form Health Survey (SF-36) questionnaire to assess QoL. SGA is a tool that can quickly assess nutritional status with minimal technical requirements and high observer agreement.[12] The SF-36 is designed to be a concise but comprehensive measure of general health status. The SF-36 is a very popular instrument for evaluating HR-QOL.[14] This HR-QOL assessment is important for the evaluation and follow-up of patients with chronic interventions such as HD.[15]

Malnutrition is common in ESRD patients receiving HD, with prevalence ranging from 18 to 75%.[16] Many factors are implicated in the risk of malnutrition in HD patients, including the catabolic effect of HD, loss of nutrients through the dialysis membrane, inflammation, and metabolic acidosis.[17] HD procedures can lead to loss of functional level with consequent decreased QoL over time.[18] Also, a lack of regular physical activity in this population may be associated with the emergence of comorbidities related to cardiovascular disease, anemia, infection, hepatitis, bone disease, and malnutrition, among others, supporting the risk of hospitalization and death.[19]

Based on the SGA scores, most of the patients in our study showed good nutritional status (SGA grade A score was 77.7%). For HD 4 hours and BFR 200-250 mL/minute, although not statistically significant, the SGA grade A score was only 57.45%, lower than HD 5 hours and BFR 200-250 mL/minute, and HD 4 hours and BFR 270-320 mL/minute, while the SGA grade B score was more dominant (40.04%) (Table 2). Lower Class A SGA in HD 4 hours and BFR 200-250 mL/minute may be closely related to shorter HD session duration and slower BFR. However, this may also be related to the higher proportion of catheter use as access for HD and the higher prevalence of DM in HD 4 hours and BFR 200-250 mL/minute compared to HD 5 hours and BFR 200-250 mL/minute, and HD 4 hours and BFR 270-320 mL/minute (Table 1). These two conditions may – in part – affect nutritional status, being associated with a higher risk of infection and inflammation**.**

Malnutrition is associated with increased morbidity, decreased functional capacity, and a greater number and duration of hospitalizations, all of which can lead to lower HR-QOL and impact on patients' emotional, physical, and psychosocial health. It has been described that malnourished patients have a worse QOL.[20,21] Although nutritional status has an impact on QOL, there is limited evidence to support this relationship.[2] In analyzing the QOL of patients undergoing HD, physical function, physical function dimensions, and CKD burden appear to be related and dependent on physical health.[22,23] This dimension is associated with persistent patient complaints such as lack of energy, feelings of hopelessness, and fatigue, which may lower scores in this dimension, possibly due to changes in their health condition related to illness and treatment.[24]

Based on the treatment group, HD 4 hours and BFR 200-250 mL/minute had the lowest SF-36 PF, and RP domain scores compared to HD 5 hours and BFR 200-250 mL/minute, while HD 5 hours and BFR 200-250 mL/minute and HD 4 hours and BFR 270-320 mL/minute had no difference (Table 3). HD 5 hours and BFR 200-250 mL/minute had the highest scores in the VT, SF, and MH domains compared to HD 4 hours and BFR 270-320 mL/minute and HD 4 hours and BFR 200-250 mL/minute (Table 3). This may be due to lower psychological distress related to the length of time patients underwent HD therapy and the proportion of male sex, which in HD 5 hours and BFR 200-250 mL/minute was the highest compared to HD 4 hours and BFR 270-320 mL/minute, and HD 4 hours and BFR 200-250 mL/minute (Table 1). Several studies have found lower levels of stress in patients undergoing longer HD therapy.[25–27] Likewise, it is associated with lower gender in males than in females.[27] However, there are other studies that provide different reports, showing that the tendency of stress levels to increase with the length of time patients undergo dialysis.[28]

Our study showed that HD 5 hours and BFR 200-250 mL/minute (slower BFR) was generally associated with the highest SF-36 scores, especially PF, RP, VT, SF and MH domain scores compared with HD 4 hours and BFR 270-320 mL/minute, and HD 4 hours and BFR 200-250 mL/minute (Table 3). This may be related to the increased adequacy of HD with longer duration, despite slower BFR. However, 4-hour HD duration with faster BFR was associated with better QOL compared with 4-hour HD duration but slower BFR. SF-36 scores of PF and RP domains of PC were higher in HD 4 hours and BFR 270-320 mL/minute compared with HD 4 hours and BFR 200-250 mL/minute (Table 3). This may be related to an increase in HD adequacy due to faster BFR, which results in improved QOL as reflected in a higher physical component value. Several studies have shown that increasing BFR increases the adequacy of dialysis.[5,6,29] Based on this, it can be postulated that inadequate dialysis may be caused by a lower BFR, which will ultimately affect clinical outcomes, including QOL. The KDOQI guidelines identify that a BFR (Qb) of less than 300 mL/min does not provide adequate clearance.[30] Several studies have also shown an association between higher BFR and higher PC scores (**Table 4**).[31,32]

Our study showed that HD 5 hours and BFR 200-250 mL/minute was associated with less use of antihypertensive drugs compared to HD 4 hours and BFR 270-320 mL/minute, and less use of ESA and blood transfusion compared to HD 4 hours and BFR 270-320 mL/minute, and HD 4 hours and BFR 200-250 mL/minute (Table 1). Longer HD has several benefits, including better blood pressure control, decreased need for antihypertensive drugs, fewer episodes of intradialytic hypotension, and reduced mortality.[33] One study also showed 26% higher mortality in the HD group of less than 4 hours (mean 201 minutes) compared to the HD group more than 4 hours (mean 240 minutes).[34]

Table 4. Summary of several studies examining the relationship between hemodialysis duration, nutritional status, and patient quality of life

Authors, year	Aim of the study	Study design	No. of studies included	Summary of results (key findings)
Nunes FT et al, 2008.[1]	To determine the correlation between the adequacy of dialysis and the nutritional status of HD patients	Cross-sectional study.	Involving 44 adult patients, undergoing dialysis three times a week at the Kidney Institute in Rio Claro, São Paulo state.	Dialysis adequacy is related to nutritional status and is influenced by protein intake and body composition. Female and younger patients tend to demonstrate better dialysis adequacy.
Visiedo L et al, 2022.[2]	To examine the utility of the Malnutrition-Inflammation Score (MIS) in detecting nutritional risk (NR) and assessing the correlation between nutritional status and Quality of Life (QOL) in dialysis patients at the start of a nutrition intervention program (NIP).	cross-sectional study.	A total of 120 HD patients with the following inclusion criteria: adults, have been on HD for at least three months, and have HD sessions three times a week (4 hours per session)	Malnutrition was found to be the most significant predictor of impairment scores on the KDQOL-SF.
Lessan-Pezeshki M et al, 2009.[23]	To determine the KDQoL score and its associated factors among patients undergoing dialysis	cross-sectional study	Involving 170 hemodialysis patients: age over 18 years, dialysis duration more than 3 months, and HD three times a week (4 hours per session)	Male gender, age < 50 years, high education level, marital status, and employment status had better PCS, MCS, and KDCS.
Tu HY et al., 2013.[25]	To describe the stressors, stress levels, and coping strategies of Taiwanese patients aged 20-45 years undergoing chronic hemodialysis.	cross-sectional study	involving 88 dialysis patients at six dialysis centers in southern Taiwan.	The most common stress triggers are fluid restriction, dietary restrictions, and fatigue. The longer a patient undergoes hemodialysis, the lower their stress levels.
Qaddami AS et al.[26]	To assess stressors among hemodialysis (HD) patients and to find out whether there is a relationship between these stressors and patient characteristics.	cross-sectional study	Involving 120 of a total of 379 HD patients who responded to the HD stress scale in the North of the West Bank.	There is a significant difference between psychosocial stressors and the duration of dialysis treatment.
Gorji MA et al., 2013.[27]	To survey physiological and psychosocial stress among HD patients.	cross-sectional study	Involving 80 HD patients in two teaching hospitals in Northern Iran.	HD patients have significant physical and psychosocial problems. Stress levels are higher in married women, younger women, women with lower dialysis age, and those with lower education.
Lok P, 1996.[28]	To determine significant stressors and coping methods related to quality of life in dialysis patients.	cross-sectional study	Involving dialysis patients in Sydney with a response rate of 58% (and = 64).	The most disturbing stressors were: limited physical activity, decreased social life, uncertainty about the future, fatigue, and muscle cramps. Length of time on dialysis was not significantly associated with coping behaviours.
Kim YO et al, 2004.[29]	To determine the effect of increasing blood flow rate on dialysis adequacy in HD patients with low Kt/V.	Cohort study	Involving 36 HD patients with single-pool Kt/V <1.2 per session three times a week, as measured by a dialyzer blood flow rate of 230 mL/min.	An increase in blood flow rate of 15–20% from the previous flow rate is effective in achieving dialysis adequacy in HD patients with low Kt/V.

Nugroho P et al, 2019.[31]	To determine the strength of the relationship between BFR and QoL in dialysis patients.	cross-sectional study	Involving 132 patients who met the study criteria at the HD Unit of Dr. Cipto Mangunkusumo Hospital (RSCM), Jakarta, Indonesia.	Increasing BFR to >250 ml/min appears to be associated with improved Quality of Life in patients undergoing HD and lower mortality rates.
Yusop NB, et al., 2013.[32]	To determine the relationship between medical history, hemodialysis treatment, and nutritional status with the mental and physical components of quality of life in hemodialysis patients.	cross-sectional study.	Involving 90 respondents from Kuala Lumpur Hospital and the Malaysian National Kidney Foundation dialysis center.	Higher MCS scores were associated with diabetes mellitus and lower serum calcium. Higher PCS scores were associated with higher blood flow, higher serum creatinine, and lower protein intake.
Flythe J E, et al, 2013.[34]	To test whether three times weekly hemodialysis patients with shorter dialysis session durations are associated with mortality, regardless of body size.	Cohort study	Involving 10,571 subjects with a mean age of 62.2 ± 15.0 years.	Dialysis session duration of less than 240 minutes was significantly associated with increased all-cause mortality (adjusted hazard ratio 1.26).
Tentori F et al, 2012.[36]	To assess the relationship of treatment time (TT) with clinical outcomes of HD patients.	Cohort study	Involving 37,414 patients undergoing HD three times a week with prescribed treatment times ranging from 120 to 420 minutes.	Patients with longer TT are associated with better clinical outcomes. Shorter dialysis session duration is associated with increased mortality, regardless of body weight.
Kitagawa M, et al., 2017.[37]	To evaluate the effect of dialysis session length on MH and PF in elderly HD patients as an indicator of HRQOL.	Cohort study	Involving 1,187 patients aged 65 years and older, on HD for at least 120 days at 121 HD facilities in Japan	Shorter dialysis session duration had no adverse effects on MH or PF in elderly patients.
Bohlke M et al, 2008.[38]	To find predictors of Quality of Life (QoL) among sociodemographic and clinical factors of HD patients.	Cross-sectional study	Involving 140 patients: 94 hemodialysis patients and 46 peritoneal dialysis patients in three dialysis facilities in southern Brazil.	Age, comorbidities, and duration of dialysis are the main predictors of physical QoL, while socioeconomic issues in particular determine mental QoL.

However, a meta-analysis showed that increasing the length of dialysis sessions failed to improve patient survival.[35]

Studies in the elderly population have shown better intermediate QoL in patients receiving longer treatment times.[36] On the other hand, another study showed different results, that shorter HD in the elderly population (>65 years) was not associated with lower MH and PF. Longer HD is associated with impairment due to back pain and burden due to reduced activity.[37] Another study also showed no association between HD and PF session duration. There is an association between short dialysis sessions and better PF in conventional HD patients.[38] (Table 4). One of the psychosocial stressors faced by patients undergoing HD is the length of time undergoing dialysis.[39] An important factor affecting Kt/V is the duration of dialysis. However, this is not always easy to implement in daily practice, as this longer dialysis time can have an impact on the economy and poor patient compliance.

In daily practice, HD implementation in Indonesia still has many variations and limitations. There are variations in the duration of each HD session, the frequency of HD per week, the size and type of dialyzer used, the blood flow rate (BFR), and so on. HD therapy is a procedure with a high-cost burden. Of the various HD prescribing methods to increase adequacy, increasing the BFR rate is one way to increase adequacy without additional costs. For low- and middle-income countries (LMIC) like Indonesia, it is crucial to determine the HD duration and

BFR that provide the most optimal results. Based on our study results, where a 5-hour HD duration was not associated with better nutritional status (SGA class A scores were similar across groups) and the cost burden was clearly higher, it appears that the HD prescribing pattern with relatively good outcomes and lower costs is in group II, namely a 4-hour HD duration, with a BFR of 270-320 ml/minute.

Therefore, based on the results of this study, we recommend a 4-hour, twice-weekly HD prescription pattern with a faster BFR as a more rational HD prescription pattern to be implemented in Indonesia. This is especially true if this HD prescription pattern is also supported by the use of a faster dialysate flow rate, a larger dialyzer size, and the use of a high-performance dialyzer. Although increasing dialysis duration (e.g., 5 hours) is beneficial for improving Kt/V, this is not always feasible due to economic factors and patient intolerance.

LIMITATIONS OF THE STUDY

This study has several limitations, primarily related to the RWE study itself. Studies using RWE methods clearly have several limitations, including low internal validity, poor quality control during data collection, and potential bias in the study results. Furthermore, the proportion of diabetes as the primary cause of ESRD, the type of HD access used, the use of antihypertensive medications, and blood transfusions were not comparable between groups, potentially influencing clinical outcomes. We also did not measure urea clearance and other biochemical parameters related to nutritional status.

CONCLUSION

Our study showed that HD 5 hours and BFR 200-250 mL/minute gave the same outcome of SGA class A score as HD 4 hours and BFR 270-320 mL/minute, but with a QOL value based on the SF-36 score which was generally higher than the other 2 groups, especially with HD 4 hours and BFR 200-250 mL/minute. Meanwhile, HD 4 hours and BFR 200-250 mL/minute gave the lowest SGA class A score and SF-36 score compared to HD 5 hours and BFR 200-250 mL/minute, and HD 4 hours and BFR 270-320 mL/minute.

CONFLICT OF INTERESTS

There are no relevant potential interests with respect to this manuscript.

AUTHOR CONTRIBUTIONS

Conceptualization, N.S; data curation, N.S, D.S.V, F.W., W.W.; formal analysis, N.S; investigation, A.R.S., R.T.; methodology, N.S and, A.G.K.S.; project administration, R.T, A.G.K.S.; software, N.S; supervision, K.K., W.W.; validation, N.S; writing—original draft, N.S.; writing—review & editing, N.S.

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