ORIGINAL ARTICLE

Post Hemodialysis Recovery Time Among End-stage Renal Disease' Patients Undergoing Hemodialysis

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ABSTRACT

Introduction: Prolonged recovery time is associated significantly with higher hospitalization and mortality, while the factors influencing recovery time post- hemodialysis is still a problem and contradictive. The study examines the length of recovery time and related factors among hemodialysis patients. **Methods:** A quantitative study with a descriptive analytic design was used by incorporated 101 patients undergoing hemodialysis recruited by consecutive sampling. The patients were asked how long it took to recover after a previous hemodialysis session, while the recovery time was assessed using the questionnaire developed by Lindsay and calculated in hours comprising <6, 6-12, and > 12 hours. Furthermore, the demographic data and hemodialysis factors were analyzed to identify associated factors with recovery time. **Results:** The results showed that the recovery time in categories of < 6, 6-12, and >12 hours were reportedly 45.5%, 37.6%, and 16.8%, respectively. In this study, data demographic showed the respondents' age ranged from 45 – 59 years (44.6%), while the majority of gender was male (54.5%). Moreover, hemodialysis factors showed most respondents (44.6%) have been undergoing hemodialysis for 1-3 years, and the schedule was mostly in the morning. Moreover, the quick of blood (QB) was dominated by ≥ 200 ml/minutes (69.3%), ultrafiltration rate (UFR) was 5 - ≤15 ml/minutes (68.3%), and hemodialysis adequacy (Kt/V) was ≥ 1.2 (79.2%). Biochemical status showed that most of patient's hemoglobin level was < 10 mg/dl (72.3%) The recovery time post-hemodialysis was found to be significantly associated with gender, hemodialysis schedule, ultrafiltration rate, interdialytic weight gain, and hemoglobin (p-value < 0.05). The multiple regression analysis found a significant correlation for interdialytic weight gain (IDWG) with a coefficient of 0.479. **Conclusion:** This study showed that the recovery time is related to certain variables among patients undergoing hemodialysis.

Keywords: End-stage kidney disease; Hemodialysis; Recovery time

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INTRODUCTION

End-stage kidney disease (ESKD) patients undergoing hemodialysis usually have significantly impaired health-related quality of life compared to the general population (1–3). Meanwhile, one factor associated with this condition is the prolonged post-hemodialysis recovery time (4,5).

Hemodialysis patients are at risk of experiencing adverse effects, including cramps, headaches, and fatigue (6). During hemodialysis, several changes occur such as imbalance fluid and electrolytes, metabolic products removal, as well as certain changes in biochemistry and volume during dialysis (7). Therefore, it is not surprising that patients usually complain about the number of symptoms during and immediately after hemodialysis (8).

Post-hemodialysis recovery time was introduced by Lindsay et al. (2006) as an indicator of the quality-of-life for patients undergoing hemodialysis. It is defined as the time required for patients to recover after hemodialysis sessions, a measured and validated measure of post-dialysis fatigue (5). Based on a study, 87,5% of patients undergoing hemodialysis complaint about fatigue (9).
Recovery time from the hemodialysis session is a permanent problem among the majority of patients receiving HD treatment. Patients described this

condition as a feeling of being "washed out", weak, or without energy (10). These symptoms reduce the capacity to perform daily activities and impair the patient's well-being. Furthermore, prolonged recovery time is associated with poor survival and risk for hospitalization (11). Rayner et al. (2014) reported that patients with recovery times over 12 hours had a 22% increased risk of hospitalization and 47% higher risk of death compared to others with a recovery time of 2 – 6 h.

The post-hemodialysis recovery time is measured by asking patients to quantitatively describe how they feel after dialysis (11). Prolonged recovery time is frequent on patients undergoing hemodialysis with 27% reporting a recovery time of 6 hours and longer, while 68% took more than 2 hours to recover from a dialysis session (12). The factors associated with recovery time are still different and controversial in each other studies. The understanding of prolonged post-hemodialysis recovery time which causes a higher risk for hospitalization and mortality is expected to clarify and improve the existing problem. Therefore, this study aims to assess post-hemodialysis recovery time and identify associated factors among hemodialysis patients.

MATERIALS AND METHODS

This was a descriptive study with a cross-sectional design performed in a public hospital in West Sumatera. The number of total samples was 101 patients undergoing hemodialysis. It was selected by using consecutive sampling, in which every subject meeting the criteria of inclusion in collecting data from July- September 2021 is selected until the required sample is achieved. The inclusion criteria were patients receiving hemodialysis twice a week, receiving regular hemodialysis at least for three months with durations of 4 – 4.5 hours, aged ≥ 18 years, conscious and able to read as well as write. After inclusion into study, all patients were assessed for the recovery time.

The recovery time was examined using questions developed by Lindsay et al. (2006) including "How long does it take you to recover after a hemodialysis session?". The patients were asked by using the Indonesian language. This study assessed the recovery time of patients in previous hemodialysis sessions, while the answers were recorded and converted into categories namely < 6, 6-12, and > 12 hours. The demographic information, factors hemodialysis and clinical characteristics were collected using the respondents' data and observation sheets. Data demographic is including age and gender. Also, factors of hemodialysis consists of length of hemodialysis, hemodialysis session, interdialytic weight gain (IDWG), ultrafiltration rate (UFR), quick of blood (QB), hemodialysis adequacy (Kt/V) is collected. Moreover, hemoglobin as biochemical parameters are reported.

For hemodialysis factors, interdialytic weight gain (IDWG) is calculated with pre-dialysis weight minus post-dialysis weight in the previous session. This study was categorized IDWG, including < 2 kg and ≤ 2 kg. Ultrafiltration rate (UFR) is amount of fluid removed during a dialysis session (ultrafiltration) as well as the session length (dialysis treatment time) which divided into < 5 ml/minutes, 5 - ≤ 15 ml/minutes, and > 15 ml/minutes. Quick of blood (QB) is one of the parameters of hemodialysis prescription, defined as blood flow rate from the patient's body to dialyzer. Quick blood (QB) is controlled independently depending on patient's condition. In this study, QB is divided into < 200 ml/min and ≥ 200 ml/min. Also, to determine hemodialysis adequacy (Kt/V) used the Daugirdas formula. The results were categorized into adequate and inadequate. It was called adequate if the result was ≤ 1.2 and inadequate < 1.2.

The data were analyzed using univariate and bivariate analysis, subsequently, to examine the relationship between recovery time and dependent variables, the Chi-Square test was used. Moreover, the analytical statistic was continued with ordinal regression to identify the most influential variables of recovery time. All statistical analysis was done using SPSS.

This study is strictly compliance with the relevant ethical guidelines and considerations. This study was reviewed by M. Djamil Hospital Ethical Council Committee with the number 210/KEPK/2020.

RESULT

The respondents' age ranged from 45 – 59 years, with a total of 45 or 44.6%, while the majority of gender was male, with a total of 55 (54.5%). According to the hemodialysis factor, most respondents have been undergoing hemodialysis for 1-3 years, with a total of 45 (44.6%), and the schedule was mostly in the morning. Furthermore, the hemoglobin level of patients was < 10 mg/dl with a total of 73 (72.3%). In this study, the quick of blood (QB) was ≥ 200 ml/minutes in a total of 70 respondents (69.3%), while ultrafiltration was mostly 5 - ≤15 ml/minutes in 69 respondents (68.3%). The range of hemodialysis adequacy was ≥ 1.2, in a total of 80 respondents (79.2%), while the recovery time was divided into < 6 hours, 6-12 hours, and > 12 hours, with a range of < 6 hours in 46 respondents (45.5%) (Table I).

Table II shows the analysis results of demographic data, hemodialysis factors, and recovery time. Based on the results, there were associations between demographic factors and recovery time namely gender and recovery time with a p-value of 0.001. Moreover, the analyzed hemodialysis factors showed that interdialytic weight gain (IDWG) significantly correlates with recovery time (p-value: 0.014), hemodialysis schedule (p-value: 0.006) and ultrafiltration rate (UFR) (p-value: 0.040).

Also, hemoglobin as a biochemical parameter for hemodialysis patients in this study is associated with

Table I. Demographic Respondents and Hemodialysis Factors (n=101)

Variables	n	%
Ages		
17-44	25	24.8
45-59	45	44.6
>60	31	30.7
Gender		
Male	55	54.5
Female	46	45.5
Length of Hemodialysis (year)		
< 1	42	31.7
1-3	42	44.6
>3	12	23.8
Hemodialysis Schedule		
Morning	67	66.3
Afternoon	34	33.7
Interdialytic Weight Gain (IDWG) (kg)		
< 2	47	47.5
≥2	54	52.5
Hemoglobin Level		
< 10	73	72.3
≥10	28	27.7
Quick Blood (QB)		
<200	31	30.7
≥200	70	69.3
Ultrafiltration (UFR)		
< 5 ml/minutes	27	26.7
5– < 15 ml/minutes	69	68.3
>15 ml/minutes	5	5
Kt/V		
≥1.2	80	79.2
<1.2	21	20.8
Recovery Time (hour)		
< 6	46	45.5
6-12	38	37.6
>12	17	16.8

Table II. Analysis of Demographic Data, Hemodialysis Factors and Recovery Time (n=101)

Variables	Recovery Time						Total		p-value
	<6		6-12		>12				
	n	%	n	%	n	%	n	%	
Ages									
17-44	11	11.4	10	9.4	4	4.2	25	100	0.23
45-59	16	20.5	21	16.9	8	7.6	45	100	
>60	19	14.1	7	11.7	5	5.2	31	100	
Gender									
Male	34	61.8	16	29.1	5	9.1	55	100	0.001*
Female	12	26.1	22	47.8	12	26.1	46	100	
Length of Hemodialysis (year)									
<1	23	48.9	18	38.3	6	12.8	47	100	0.138
1-3	18	42.9	18	42.9	6	14.3	42	100	
>3	5	41.7	2	16.7	5	41.7	12	100	
Hemodialysis Schedule									
Morning	27	30.5	23	67	17	11.3	67	100	0.006*
Afternoon	19	15.5	15	12.8	0	0	34	100	
IDWG (kg)									
<2	27	57.4	17	36.2	3	6.4	47	100	0.014*
≥2	19	35.2	21	38.9	17	16.8	54	100	
Haemoglobin (mg/dl)									
<10	29	33.2	28	27.5	16	12.3	73	100	0.049*
≥10	17	12.8	10	10.5	1	4.7	28	100	
Quick Blood (QB)									
< 200	9	29	15	48.4	7	22.6	31	100	0.085
≥ 200	37	52.9	23	32.9	10	14.3	70	100	
UFR (ml/minutes)									
<5	11	12.3	15	10.2	1	4.5	27	100	0.040*
5-≤15	31	31.4	22	26	16	11.6	69	100	
>15	4	2.3	1	1.9	0	0	5	100	
Kt/V									
≥1.2	33	36.4	33	30.1	14	13.5	80	100	0.223
<1.2	13	9.6	5	7.9	3	3.5	21	100	

recovery time (p-value: 0.049).
Table III shows the analysis results of ordinal regression which indicated that the significant variable with the most significant effect on post-hemodialysis recovery is interdialytic weight gain (IDWG) with coefficients of 0.479.

Table III. Analysis of Ordinal Regression of Variables Recovery time

Variables	Coefficients	Wald	p-value
Gender	0.473	3.902	0.048
Hemodialysis Schedule	0.526	3.265	0.071
IDWG	0.479	4.365	0.037*
HB	0.521	2.263	0.132
UFR	1.365	1.365	0.663

DISCUSSION

Based on the results, the post-hemodialysis recovery time in the categories of < 6, 6-12, >12 was 45.5%, 37.6%, and 16.8% respectively. The majority of patients (n = 46) reported a recovery time of < 6 hours and only 17 had more than 12 hours, while the mean was 448.86 minutes (7 hours). As reported by The Dialysis Outcomes and Practice Patterns Study (DOPPS), prolonged recovery time is common in 27% of patients that reportedly took more than 6 hours to recover Rayner (2017), while Hussein et al. (2017) found that patients took over 12 hours to recover. Recovery time is defined as the duration needed by the patient to recover from fatigue and to rest or sleep. The results show that the greater the changes during and after hemodialysis, the more prolonged the recovery time. Meanwhile, the pathophysiology of recovery time has been investigated but was not completely understood (11).

The age range of the respondent was 45 – 59 years, with a total of 45 (44.6%), also, the relationship between recovery time and demographic factors such as age and gender were analyzed. There was no relationship between age and recovery time as demonstrated by a p-value of 0.23. This result is consistent with other studies conducted by Awuah et al. (2013), Bossola & Tazza (2016), Lopes et al. (2014), Smokovska et al. (2015) and Antari et al. (2019) which showed that there was no relationship between age and recovery time after hemodialysis. However, there is no clear explanation regarding this, perhaps it can be explained by the various age ranges of patients and the length of time.

There was a significant relationship between gender and recovery time with a p-value of 0.001). This is in line with Rayner et al. (2014) which reported that males have a shorter post-hemodialysis recovery time than females. Recently, a study found that females tend to experience unpleasant complaints, such as fatigue and exacerbations of post-hemodialysis energy that are more severe than males, this explains the cause of prolonged recovery time (17). The severity of the complaints felt by female respondents correlated with sleep disorders which are frequently experienced (18).

This study demonstrated that there are several factors significantly associated with recovery time. There was an association between hemodialysis schedule and recovery time (p-value: 0.006), this is in line with Lopes et al. (2014) and Antari et al. (2019). Lopes et al. (2014) explained that patients with an afternoon hemodialysis schedule needed a longer recovery time than a morning or evening schedule, while Antari et al. (2019), stated that hemodialysis tends to affect sleep quality among patients due to interleukin-1 which causes drowsiness. Patients on a schedule in the afternoon and fall asleep on hemodialysis tend to have trouble sleeping at night.
Furthermore, the results showed a relationship between ultrafiltration rate (UFR) and recovery time after hemodialysis (p-value: 0.000). Data on the correlation between recovery time and UFR are few and conflicting. Meanwhile, this study is in line with Bossola et al. (2019) which reported that UFR is one of the variables that influence recovery time, lower UFR indicates shorter recovery time and vice-versa. However, Rayner et al. (2014) found associations of fast ultrafiltration rates and shorter dialysis treatment time with shorter recovery time. The study explained association between recovery time and UFR, patients with both slow and fast UFR (< 5 and > 15 ml/ min respectively) being associated with a shorter recovery time compared with UFR of 5 – 15 ml/ min. It can be hypothesized that the UFR may influence the production of cytokines or their removal and consequently the recovery time. Unfortunately, there is no other evidence about the effect of UFR on cytokine production and removal, unlike data on removal of cytokines and type of hemodialysis filter.

This study also showed a correlation between IDWG and post-hemodialysis recovery time (p-value: 0.014). A previous study conducted by Rayner et al. (2014) and Bipin Kumar S V, Karthikeyan B, Nair SV, Ramasamy A, Khan S (2021) found that longer recovery time is associated with higher interdialytic weight gain. Also, low intradialytic weight gain is associated with shorter recovery time, hence, recovery might be quicker after treatments in which fluid shifts are slow and of small volume. The majority of patients in this study had increased IDWG up to 2 kilograms. The study showed that higher IDWG led to prolonged recovery time. In this study, hemodialysis is carried out twice a week and has an effect on IDWG and even Kt/V which will have an impact on recovery time.

There was also a correlation between hemoglobin and recovery time after hemodialysis (p-value: 0.049). This is in line with Smokovska et al. (2015), which showed that the level of albumin, urea, and hemoglobin is related to the recovery time. These laboratory variables potentially reflect the patients' nutritional status and contribute to the overall better physical conditions to reduce

the stress of the hemodialysis treatment. In this study, hemoglobin reflected the patients' nutritional status and was associated with recovery time.

CONCLUSION

Recovery time significantly impacts the patient and might be affected by various modifiable aspects of the treatment regimen. Based on the results, several variables affect recovery time after hemodialysis, including IDWG, HB, gender, hemodialysis schedule, and UFR. Consideration of the impact on hemodialysis patients is recognized to improve the assessment of the recovery time. However, further intervention studies are needed to provide evidence on reducing recovery time and improving quality treatment in hemodialysis units.

LIMITATION

It was known several laboratory tests affect recovery time such as albumin, NPCR, calcium, etc. However, this study does not provide all laboratory tests because not all of the patients have had these examinations. Yet, these parameters were not used as a routine evaluation assessment.

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