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Original Article

The Duration of Hemodialysis and its Implication to Barthel Score and Laboratory Parameters among End Stage Renal Disease Patients

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ABSTRACT

Background: While it was proven that hemodialysis for treating patients with end stage renal disease (ESRD) provided the reduced mortality rate, the reports on its adequacy in the context of laboratory parameters and psychological function were limited. **Aim:** To assess the implication of hemodialysis duration on Barthel score and laboratory parameters among ESRD patients. **Methods:** During the period, a cross-sectional study was conducted at Dr. Soetomo General Hospital. Information related to age, gender, history of hypertension, history of diabetes mellitus, and the levels of hemoglobin, albumin, calcium, and phosphor were retrieved from medical records. While, we performed the interview to each participant using Barthel index questionnaire to assess the function independence. We used multiple logistic regression analysis to determine the correlation and estimate of effect. **Results:** We totally include we included 65 patients with the hemodialysis duration of more than one year and 16 patients with the hemodialysis duration of less than one year. Our results found that the higher levels of albumin and hemoglobin were observed in patients with hemodialysis duration of more than one year. While, the duration of hemodialysis did not affect the Barthel score and serum mineral parameters. **Conclusion:** The duration of hemodialysis of more than one year is associated with the improvement of albumin and hemoglobin levels.

Keywords: Hemodialysis duration, End Stage Renal Disease, Laboratory parameters, Barthel index

INTRODUCTION

End stage renal disease (ESRD) remains the major health problem worldwide. The morbidity of this disease was reported ranging from 7.60% to 14.44%,[f] and the mortality was reported 5-10 million annually.[2] The morbidity of this disease was reported to increase approximately 4.77% in the last two decades, and in the next ten years, the morbidity was predicted to increase approximately 1.19 to 1.95%.[3] The managements of ESRD is complex, and it consists of renal transplantation and dialysis.[4] Of them, hemodialysis is the widest

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method applied to treat ESRD patients, and it was proven that hemodialysis was associated with 12%–27% reduced risk of mortality during the interval between 1995 and 2013.[5] However, some studies have had concerned that the implementation of hemodialysis for treating ESRD patients was accompanied by some issues, the lack of adequacy management.[6-8] Moreover, due to ESRD is a chronic disease and the treatment for this disease requires discipline to routinely control, the psychological function of ESRD patients might be affected.

The tools to assess the adequacy of hemodialysis treatment among ESRD patients either using clinical or laboratory criteria are the valuable method to ensure that the adverse condition caused by renal impairment does not occur. In the context of ESRD, the laboratory parameters that might reflect the chronicity of the disease including the levels of hemoglobin, albumin, and mineral parameters might provide the prominent role to assess the adequacy of hemodialysis. [6-8] Moreover, the psychological function of ESRD patients might also play a prominent implication for the patients to routinely visit to hemodialysis clinic. In some countries such as in India, Korea, and Singapore; the psychological function had been reported to cause the compliance of ESRD patients who routinely visited hemodialysis clinic,[9-11] and therefore, psychological function of ESRD patients was considered as the pivotal factors that should be assessed in ESRD patients. In our country, the study reporting factors associating with the adequacy of hemodialysis patients had never been performed before. Therefore, our current study aimed to assess the implication of hemodialysis duration to the Barthel score and levels of hemoglobin, albumin, and mineral parameters among ESRD patients.

METHODS

Study designs and participants

A cross-sectional study was conducted in Dr. Soetomo General Hospital, Surabaya, Indonesia. The target population was all hemodialysis patients treated in Dr. Soetomo General Hospital during June 2019 to June 2020. The inclusion criteria were (1) ESRD patients treated with hemodialysis in Dr. Soetomo General for more than three months and the frequency was twice per week, and (2) able to communicate in Bahasa Indonesia. Patients with one of the following conditions: age under 14 years, hemodynamically unstable, and having the indication for admission were excluded from our study. Information related to gender, age, history of hypertension, history of diabetes mellitus, duration of hemodialysis, and the level of urea, creatinine, calcium, phosphor, albumin, and complete blood count was extracted from medical record. While, for information related to functional status, we performed interview in accordance with Barthel index.[12] In our present study, a total sampling method was used.

Ethical approval

The study was approved by the Institutional Review Board of Universitas Airlangga, Surabaya, Indonesia (No. 000/XX/XX/2019) in accordance with declaration of Helsinki. All subjects had provided written informed consent prior to participate in this study. All subjects in our study were voluntary and we did not provide any incentive.

Outcome measure

In our study, the predictor covariate was the duration of hemodialysis, divided into less than or equal to one year and more than one year. While, the outcome measures were Barthel score and the levels of calcium, phosphor, albumin, and hemoglobin. Those laboratory parameters were retrieved from medical record (secondary data).

Statistical Analysis

The association between the duration of hemodialysis and Barthel score and the levels of hemoglobin, albumin, calcium, and phosphor was analyzed using multiple logistic regression analysis. Statistically significant was considered if the p value was less than 0.05. We used the Statistical Package of Social Sciences 17.0 software (SPSS Inc., Chicago, IL) to analyze the data.

RESULTS

Characteristics of Patients

A total of 81 hemodialysis patients, we enrolled in this study and divided into 65 patients with the duration of hemodialysis of more than one year and 16 patients with less than one year, were analyzed. The average age was 47.30 and 45.02 years for hemodialysis patients with the duration of less than one year and more than one year, respectively. Other baseline characteristics of the patients such gender, the history of hypertension, and the history of diabetes mellitus are presented in **Table 1**. The data showed no significant different between both groups, indicating that the data was presented homogeneously.

Table 1. Baseline characteristics of patients in this study

Characteristics	≤ 1 years (n=16)	> 1 years (n=65)	p
Age	47.30 ± 9.69	45.02 ± 10.11	0.4740
Male	50.00	53.73	0.7990
Hypertension	68.75	56.92	0.3910
Diabetes mellitus	43.75	20.00	0.0550

Notes, data were presented in mean ± SD or %

The implication of hemodialysis duration to the Barthel score and laboratory parameters.

The average number of Barthel score and the levels of calcium, phosphor, albumin, and hemoglobin are presented in **Table 2**. We found that the higher levels of hemoglobin and albumin were significantly found in hemodialysis patients with the duration of more than one year compared to less than one year **(Table 2)**. While, for other covariates including Barthel score and the levels of calcium and phosphor, we failed to confirm their correlation the duration of hemodialysis.

Table 2. The summary of Barthel score and laboratory parameters between hemodialysis duration of less than five years and more than five years among stage 5 chronic kidney disease patients

Parameters	> 1 years (n=65)	≤ 1 years (n=16)	OR	95% CI	p
ADL (Barthel score)	18.48 ± 2.84	18.68 ± 1.49	0.52	0.21-1.34	0.1760
Phosphor	6.63 ± 3.39	5.26 ± 1.42	2.13	0.35-13.02	0.4130
Calcium	8.80 ± 1.38	8.78 ± 1.31	1.00	0.16-6.18	1.0000
Hemoglobin	9.77 ± 1.75	8.81 ± 1.63	2.81	1.08-7.32	0.0340
Albumin	4.46 ± 2.79	3.58 ± 0.39	16.13	11.85-21.96	<0.0001

Note, data were presented in mean ± SD; ADL, activities of daily living.

DISCUSSIONS

Our findings showed that, while anemic condition was observed in both groups, lower hemoglobin levels were found in patients with hemodialysis duration of less than one year. Our current findings were consistent to the previous studies in US, Japan, and Iran. they had clarified that shorter duration of hemodialysis was correlated to lower levels of hemoglobin compared to longer duration of hemodialysis among patients with ESRD, and the improvement of hemoglobin levels among ESRD patients was associated with lower risk of mortality.[13-15] The underlying causes of our findings regarding hemodialysis duration and the levels of hemoglobin had not been clearly elucidated. However, it was proposed that the levels of hemoglobin in patients with ESRD might be related to the disease chronicity.[16] A study revealed that disease chronicity remained the prominent factor affecting hemoglobin levels, suggesting that renal damage might also attribute to the levels of hemoglobin.[17] Moreover, anemia was reported the most common complication of ESRD.[18] In our present study, longer duration of hemodialysis might be related to the improvement of renal function and thereafter, it might be implicate to the levels of hemoglobin.

Our results found that normal range of albumin levels was observed in both groups, however, higher levels of albumin were significantly found in patients with the duration of hemodialysis more than one year. The correlation regarding albumin levels and the duration of hemodialysis among ESRD patients had been reported by previous studies.[19-20] Previous studies revealed that higher albumin levels were found in patients with the duration of hemodialysis of more than three years.[20-22] Moreover, studies also revealed that hemodialysis was associated with the improvement of albumin levels among ESRD patients, and the lower levels of albumin was found to associate with increased risk of mortality.[23-25] The lower levels of albumin in patients with hemodialysis duration of less than one year might be implicated by the degree of renal damage, and it might be caused by a combination of a reduced synthesis and an increased degradation of albumin.[26] It has been globally proposed that the damage of renal in patients with ESRD is irreversible and thereafter it might cause albumin loss through renal and subsequently triggers proteinuria and decreased levels of albumin in circulation among patients with the duration of hemodialysis of more than one year,[27] suggesting that renal function improvement might be occurred and thereafter, it might prevent albumin loss through renal.

Unfortunately, our present study failed to confirm the correlation between the levels of mineral parameters and the duration of hemodialysis among ESRD patients. Theoretically, the levels of mineral parameters together with the levels of hemoglobin and albumin should be related to the duration of hemodialysis.[28] It has been generally known that mineral parameters are the indicators of chronicity among ESRD patients due to renal damage,[29] and the longer duration of hemodialysis should provide the prominent implication to the improvement of renal function and thereafter it might provide the improvement of mineral parameters. However, we failed to clarify the correlation. Further

studies are required to reassess the levels of mineral parameters and the duration of hemodialysis among ESRD patients using better study design.

Our current study had identified that albumin and hemoglobin levels were observed better in patients with hemodialysis duration of more than one year. Our present results might be considered as the initial clues for the improvement of renal function among ESRD patients treated with hemodialysis for one year or more. However, our current findings also provided the contradiction, particularly regarding the levels of mineral parameters that we failed to confirm. Therefore, further studies should be performed to elucidate the more precise association.

Several important limitations were observed in our present study. First, the potential contributing factors including socioeconomic, educational level, and history of previous drugs consumption were not controlled for.[30] Second, our present study should cautiously be interpreted due to caution duet to relatively small sample size. Third, in our present study, we used case-control design, and therefore, the probability of bias might occur. Additionally, up-coming studies with eliminating the limitations of our current study might be required to provide the better levels of evidence.

CONCLUSION

Our present study finds that the levels of albumin and hemoglobin are observed better in patients with hemodialysis duration of more than one year compared to less than one year among ESRD patients. Our current study may be used as the initial clues for assessment of the hemodialysis adequacy for ESRD patients treated with hemodialysis for more than one year.

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