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The Relationship between Dialysis Adequacy and Fatigue in Patients on Maintenance Hemodialysis

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Abstract

Fatigue and inadequacy dialysis are common problem in hemodialysis patients. The dialysis inadequacy can cause an increased progression of impaired renal function, as well as the increased morbidity and mortality, and declining productivity of hemodialysis patients. Fatigue prevalence ranged from 44,7–97% from mild to severe. Fatigue is a common complaint of hemodialysis patients that can lower physical function and life quality. To determine the correlation between adequacy and the fatigue level of the patients with End Stage Renal Disease (ESRD) undergoing hemodialysis. This study used a descriptive analytic and cross sectional approach involving 75 respondents and the FACIT-G Questionnaire was used to collect the data. The inclusion criteria are male and female patients aged 18–70, undergoing hemodialysis for more than 3 months with a frequency of 2 times at least 4 hours, composmentis patients. The adequacy hemodialysis was assessed using the Kt/V formula. All data were collected during the session of hemodialysis. Pearson Product moment test wes used to analyze the data. The mean dialysis adequacy was 1.43±0.380, 57(76%) only 13 (17.3%) patients had adequate dialysis (minimum laboratory standard Kt / v = 1.8) and inadequate were 62 (82.7%) patients. The mean of fatigue was 20.07 and 62 (82.7%) respondents experienced severe fatigue. There was no significant correlation between adequacy and the fatigue level of the patients with ESRD undergoing hemodialysis with p value 0.504 ($\alpha > 0.05$). Mostly patients had inadequate dialysis, both adequate and inadequate dialysis patients had experience fatigue from mild to severe. Multiple individuale and personnel factors affect dialysis adequacy directly or conversely.

Keywords: Dialysis adequacy, End Stage Renal Disease (ESRD), fatigue.

Introduction

Dialysis adequacy is an adequate dosage of hemodialysis recommended for evaluating the effectiveness of hemodialysis. There a positive correlation between dialysis dose and normalized protein catabolic rate, hemoglobin, serum albumin, and physical health. Nowadays a great percentage of patients had inadequate HD. The duration and frequency of dialysis session, patients' complaints, and well-functioning vascular access is a several factors were influenced of HD adequacy ((El-Sheikh & El-Ghazaly, 2016), also BMI and type of heparinization (Chayati, Ibrahim, & Komariah, 2014). Inadequate hemodialysis may also result in losses and the declining productivity of hemodialysis patients. End Stage Renal Diseases (ESRD) patients undergoing hemodialysis takes 12–15 hours of dialysis every week, or at least 3–4 hours for each treatment with 2–3 times of dialysis per week schedule. This activity will take place continually throughout his life (Smeltzer, Bare, Hinkle, & Cheever, 2010).

Based on Perhimpunan Nefrologi Indonesia (PERNEFRI) Consensus (2017) and National Kidney Foundation (NKF) (2015) the measurement dialysis adequacy (Kt/V) for three times weekly of Kt/V is considered sufficient when it is greater than or equal to 1.2 and 1.8 for hemodialysis twice times weekly. Some of the factors affecting the dialysis adequacy are solute or molecule, the patient and the dialysis process itself (Yeun, Ornt, Depner, Chertow, 2015), also BMI and type of heparinization (Chayati, Ibrahim, & Komariah, 2014). There are nine factors that directly affect the measurement of dialysis adequacy in hemodialysis patients, surface area dialyzer, hematocrit, weight (body mass index/BMI), duration of sessions of hemodialysis, type of vascular access, frequency of hemodialysis in a week, the speed of blood flow, ultrafiltration average, and kind of heparinisation. The relationship between Kt/V and URR revealed that all patients with spKt/V ≥1.2 had URR ≥65% There statistically strong correlation between URR and eKt/V ($P < 0.001$) (El-Sheikh & El-Ghazaly, 2016). The result of multiple linear regression analyses suggested that sleep disorder, poor social and family functioning, comorbidity, exercise less than one hour every day, Kt/V <1.2 and high creatinine serum contribute were (Wang et al., 2016).

Increasing Quick Blood (Qb) can increase the achievement of hemodialysis adequacy. Inappropriate dialyzer and Low Blood Flow Rate (BFR) choice were the leading causes of inadequate dialysis (Nafar et al., 2017). The main obstacles to achieving an adequate dialysis dose are the type of catheter used, female sex, old age, greater body weight, shorter dialysis time and lower quick blood (Maduell et al., 2016). The most influencing factors on the value of Kt/V and URR is the surface area of the dialyzer (Amini et al., 2011). Many patients undergoing hemodialysis complaint about muscle weakness, lack energy and fatigue and the main problem is fatigue in maintenance hemodialysis. Previous studies showed that the prevalence rate of fatigue rates among hemodialysis patients range from 44.7–97%, the level of fatigue experienced is from mild to severe level (Sulistiani, Yetti, Hariyati, 2012; Horigan, J., Khakha., Mahajan, 2012; Biniaz et al, 2013; Gorji et al, 2013; Sodikin and Suparti, 2015). Fatigue is caused by physical inactivity and emotional distress (Horigan, et al., 2012). Fatigue is a serious problem for patients on hemodialysis. Low serum albumin values, presence cardiovascular disease, depressive symptoms, poor sleep quality, excessive sleepiness and restless leg syndrome are independently associated with greater fatigue in the multivariable regression model. The FACIT-F score was closely correlated with the SF-36 vitality score ($r = 0.81$, $p < 0.0001$) (Jhamb et al, 2013). Consequences of fatigue experienced by hemodialysis patients are socialization inhibition, a feeling of being isolated, losing time with family and the difficulty of activities, worsening life quality, and reducing life survival (Horigan, 2012).

One study in RSUD Margono Soekarjo indicates the general conditions like being weak, thin body, high blood pressure, anemia, itchy skin, darker skin color, decreasing appetite and experiencing nausea. These conditions an represent inadequate dialysis (Yeun, Ornt, Depper, 2015). The Previous research by Septiwi, Yetti, and Gayatri (2011)

in hemodialysis room of Margono Soekarjo hospital investigated the correlations between hemodialysis adequacy and life quality found among 101 respondents, they were 42.6% obtained hemodialysis adequacy while 57.4% did not. There is a correlation between the Quality of life and hemodialysis adequacy. Patients who got adequacy hemodialysis had 10.6 times of better life quality those who dis not. Research by Sodikin and Suparti (2015) described that the fatigue level of hemodialysis patients was predominantly moderate (67%), mild (16.5%) and severe (16.5%). However this research did not discuss the relation between the adequacy of hemodialysis and fatigue level, so the objective of this study was to determine the correlation between the hemodialysis adequacy and the fatigue levels of ESRD patients undergoing hemodialysis.

Method

This research was a correlational descriptive study through cross sectional approach with 75 participants recruited using purposive sampling in Hemodialysis Unit of Prof Dr. Margono Soekardjo Hospital in Purwokerto city, Banyumas Regency Indonesia. We used total purposive sampling technique, all patients who did hemodialysis 2 times per week there were 100, 69 patients had AV shunts and 32 patients had femoral access. But participants who are willing and meet the criteria are 90 patients. The criteria inclusions participants were men and women aged 18 –70 years, undergoing regular hemodialysis ≥3 months with a frequency of at least 2 times a week hemodialysis, able to reading and writing in Indonesian, undergoing hemodialysis process at least 4 hours. The patients were excluded with mental disorders.

The questionnaire used is a demographic questionnaire respondents, and the adequacy of hemodialysis was measured using the formula Kt/V observation sheets and questionnaires of Functional Assessment of Chronic Illness Therapy (FACIT G) to measure the level of fatigue created by Kathleen F. Tennant (2015). The questionnaire is devoted to the management of patients with chronic diseases that have been translated and tested for validity in many countries so there are many versions, including Indonesian. The Validity test showed that all of the questions were valid because r count was bigger than r table=0.279 (by Pearson correlation test) and reliable because of r11=0.646>0.6 (by Cronbach's alpha test.). The Indonesian version of the FACIT Fatigue Scale was a brief and valid to monitor important symptom and its effect on Chronic Kidney Diseases patients with routine hemodialysis (Shihobing et al., 2016).

To be able to use these questionnaires, investigators requested a permission from the FACIT-G, FACIT Fatigue Scale consists of 13 statements with a score range of 0-52. The assessment mentions that the higher the score ≥ 30, the less fatigue and a good quality of life, the lower the score below 30 indicates severe fatigue. To determine the achievement of dialysis dose researchers used guidelines PERNEFRI (2017) and NKF (2015) to measurement dialysis adequacy (Kt/V), for three times weekly of Kt/V is considered sufficient when it is greater than or equal to 1.2 and 1.8 for hemodialysis twice times weekly. The ethical clearance of the research was obtained from the ethics department of Prof Dr. Margono Soekardjo Purwokerto Hospital (No: 420/15897/VI/2016).

The research data was taken on July-August 2016 by researchers, all the patients who have been described and willing to become respondents, then signed informed consent and fill out a questionnaire. Researchers conducted observations on hemodialysis activities and recorded the results of lab measurements, then calculated the hemodialysis adequacy with the Kt/V formula. From 90 questionnaires given, only 85 returned and 10 did not complete questionnaire. All data were analyzed using SPSS software version 16, with a significant p value <0.05. The data analysis was conducted by calculating the univariate including frequency distribution and bivariate analysis used pear test on product moment with 95% confidence level. The results of the normality test using Kolmogorov-Smirnov Z showed that data were normally distributed, the score of hemodialysis adequacy variables was 0.686 and fatigue was 0.146, so the bivariate analysis used the Pearson product moment test (Dahlan, 2014)

Results

A total number of 75 patients were included, 52% of them were males and 48% were female. More than half of them (69.3%) had low education level, were married (70%). The most access used is the Arterio Venosus (AV) shunt as much as 73.3% and 98.7% of respondents are anemia (Table 1). Based on the results shows 81.23% patients achieve adequate dialysis and the most respondents 62 (82.7%) experienced a severe fatigue.

The mean average of dialysis adequacy was 1.42 and fatigue is 20.07 (table 2), which means experiencing severe fatigue, when viewed in the distribution of 82.7% (62) of respondents with scores ≥ 30, in this study used a questionnaire Facit-G Version 4 with a

Table 1 Distribution of Respondents According to Gender, Education, Occupation, Marital Status, HD Access and Hemoglobin Levels

Variable	Frequency (f)	Percentage (%)
Sex		
Male	36	52
Female	39	48
Education		
Low	52	69.3
High	23	30.7
Marital Status		
Mariied	70	93.3
Unmarried	5	6.7
Profession		
Working	55	73.3
Jobless	20	26.3
Hemodialysis Access		
AV shunt	55	73.3
Femoral	20	26.3
Hemoglobin Category		
Anemia	74	98.7
Non Anemia	1	1.3

Table 2 The Frequency Distribution of Respondents by Qb, Age, HD Duration and Dialysis Adequacy

Variable	Mean	Med	SD	Min-MAx
Quick Blood	284.03	250	37.783	200–300
Ages	49.11	50	11.681	22–73
HD Duration	24.45	22	18.789	1–108
Dialysis Adequacy	1.42	1.39	0.380	0.61–2.84
Fatique	20.07	19	5.78	10–32

Table 3 Correlation between Dialysis Hemodialysis Adequacy and Fatigue Level (n=75)

Variable	p	r
Dialysis Adequacy	0.504	0.078
Fatigue		

total score of 0–52. The assessment mentions that the higher the score show, the less fatigue and better quality of life, the lower the score below 30 indicates severe fatigue. The minimum research score is 10, so it can be concluded that all patients experience fatigue

Bivariate analysis (Table 3) by the Pearson product moment test showed no correlation between dialysis adequacy and the fatigue level in hemodialysis patients with p value 0.540 and $p > 0.05$. Based on the observation results, 17.3% achieve dialysis adequacy and 82.7% did not achieve dialysis adequacy.

Discussion

All patients experience fatigue, the results of this research support the previous studies that concluded that fatigue is the main problem of ESRD patients undergoing hemodialysis and its prevalence indicates the percentage of over 60% (Dadgari, Dadvar, & Eslam-Panah, 2015; Sodikin & Suparti, 2015; Jhamb et al., 2013). Fatigue scores increased significantly with decreasing Hb levels. HD patients with low Hb levels (<90 g/l) had significantly higer fatigue score (Yamasi, et al., 2016). Base on research data, the majority of patients did not achieve their dialysis adequacy targets. Because the minimum target for hemodialysis 2 times a week is 1.8 (PERNEFRI, 2017; NKF, 2015). The average dialysis adequacy score (1.42) is higher than Chayati, Ibrahim and Komariah (2015) research is 1.36.

The results in line with previous studies of El-Sheik and El-Gazaly (2016) and Rezaiee, Shangolian, and Shaidi (2016) which states that most dialysis adequacy is not achieved optimally. Field findings indicate that in a week almost all patients only had dialysis for 8 hours, whereas the recommendation of PERNEFRI (2017), the minimum number of hours of hemodialysis in a week was 10-15 hours. This condition contributes to the patient's dialysis adequacy achievement. Even PERNEFRI data (2017), show dialysis adequacy with a minimum limit of 1.8 for HD 2 times a week, only 69% meet the target of all dialysis in Indonesia.

Fatigue is a subjective feeling of weakness, (Jhamb et al., 2013), so that the conditions are varied depending on the patients. Based on the observation results, it revealed that the patients achieving adequacy of dialysis experienced both severe and mild fatigue. Even for those reaching adequacy, most experienced severe fatigue. This condition reflects that fatigue does not correlate directly to dialysis adequacy or even fatigue level is not a major determinant in dialysis adequacy. Physiological causes of fatigue include anemia, malnutrition, uremia, hemodialysis adequacy was not achieved, hyperparathyroidism, comorbid, sleep disorders, depression and drug side effects, (Horigan et al., 2012) result of Rezaiee, Shangolian, and Shaidi (2016) study showed that approximately half of the patients did not have an optimal level of dialysis adequacy, and multiple individuale and personnel factors affect dialysis adequacy directly or conversely. The adequacy of dialysis decreased with increased age of the patients (Anees et al., 2016). There was no significant relationship between the adequacy of hemodialysis and quality of life in all dimensions of quality of life except for the dimensions of the physical composite (Hany et al, 2019).

It is incontrast to research by Dadgari et al. (2015) who found that low levels of hemoglobin and low adequacy of hemodialysis are significantly correlated with fatigue in hemodialysis patients. Based on the results of logistic regression, it was known that there is a decrease in one component of Kt/V that can increase the risk of increased fatigue by 1.85 times. And the study of El-Sheik and El-Gazaly (2016), showed a positive correlation between dialysis dose and hemoglobin, serum albumin, normalized protein catabolic rate, and physical health. Although based on the results of research showing that almost all patients (98.7%) had anemia and suffered severe fatigue (82.7%), and most respondents not achieve dialysis adequacy. In the future, it is necessary to conduct research related to the achievement of the adequacy of hemodialysis using hemodialysis calculations with different formula parameters. There are some drawbacks of dialysis dose measurements using Kt/V, which do not take into account individual variables related to the patient such as volume control, unstable hemodynamics, clinical symptoms and biochemical parameters of the patient which are reported

to be related to patient outcomes (Vanholder, Glorieux, & Eloot, 2015).

Based on the results the majority of respondents did not achieve dialysis adequacy, in line with this, almost all respondents experienced fatigue. This reinforces the finding that there is no relationship between dialysis adequacy and fatigue. Besides that, many factors that play a role in achieving dialysis dose as well as the fatigue level of hemodialysis patients. The research data also showed that the patients received erythropoietin stimulating agents at least 2 weeks as well as iron. So that future studies need to confirm the effectiveness of Erythropoietin stimulating agents to the hemodialysis patients. It also needs to see the correlation between the levels of hemoglobin (anemia) and the fatigue level.

Based on observations, blood sampling was done for post Hemodialysis urea checkup from the blood taken from the venous line and carried out by nurses on duty in the rooms. As already disclosed by a research of Septiwi et al. (2011), blood samples taken from the venous line does not reflect the composition of circulating blood urea in the patients body in real. In hemodialysis room nurses and doctors have not measured the patient's fatigue level, dialysis adequacy is measured every 4-6 months. During the research process the health workers also have not provided programmed education especially related to fatigue and the importance of adequate dialysis doses, education is incidental when needed or patient requests, this is caused due to insufficient number of nurses, one nurse is responsible for 6 patients. It needs to be reconsidered regarding the minimum standard of dialysis hours which is 10–15 hours per week, considering that currently only 8 hours per week. The imitations of this study are the small number of partisipants, only use single value Kt / V, it is necessary to develop other similar studies involving more samples and various laboratory parameters.

Conclusion

There is no significant relationship between dialysis adequacy and the fatigue level in hemodialysis patients. We suggest that the inadequacy of dialysis and fatigue is a common condition in hemodialysis patients and to improve service to these patients, nurses and physicians should be informed and educated about these conditions and give hemodialysis appropriate on schedule and guideline.

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