

RESEARCH ARTICLE

THE RELATIONSHIP BETWEEN ADEQUACY OF HEMODIALYSIS AND ANEMIA IN CHRONIC KIDNEY DISEASES (CKD) PATIENTS UNDERGOING HEMODIALYSIS IN DIALYSIS UNIT, FATMAWATI HOSPITAL

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ABSTRACT

Background: Anemia is a common problem that often occurs in patients with CKD undergoing hemodialysis. 56.5% of hemodialysis patients were still have anemia, while on the other hand, the achievement adequacy of hemodialysis only reached 52.7%. Kt/V (Daugirdas Formula) and Urem Reduction Rate (URR) are often use to measure adequacy of hemodialysis. Disparity of anemia and adequacy of hemodialysis's data is the basis for this research. The aim of this study was to analysis of the relationship between the achievement adequacy of hemodialysis with the incidence of anemia in patients with CKD undergoing hemodialysis.

Methods: This study used a descriptive method with cross sectional approach which was conducted on 134 hemodialysis patients. We categorize anemia if the haemoglobin value is <10 mg/dl. For adequate hemodialysis

called as adequate if the Kt/V value is ≥ 1.8 (HD 2 times a week) or $Kt / V \geq 1.2$ (HD 3 times a week). URR was adequate if $\geq 65\%$ (HD 2 times a week) and $\geq 80\%$ (HD 3 times a week). The relationship between variables was tested by Chi Square Test.

Results: Range of age the respondents were 13-86 years, the most common vascular access was AV fistula (68.7%), and women were the most respondents (55.2%). The Kt/V value in this study was 1.67 (1.03-2.75) and an adequate one was 54.5%. Adequate URR reached 80.6% with a mean of 75.13 ± 6.38 . The incidence of anemia reached 53.7% with the Hb value at 8.93 ± 2.82 mg / dl. The results of the Chi Square test showed that HD adequacy (Kt/V and URR) with the incidence of anemia had P values of 0.670 and 0.217.

Conclusion: There is no significant relationship between HD adequacy and the incidence of anemia

Keywords: anemia, hemodialysis, hemodialysis adequacy, CKD on HD

INTRODUCTION

Hemodialysis (HD) is a method intended for patients with kidney failure to remove metabolic waste products such as potassium and urea from the blood. HD does not only aim to extend life expectancy but also to achieve a good quality of life for patients.¹ The quality of life of patients with CKD on HD will be good if the HD is adequate and there are no physical complaints. Physical complaints that often occur are generally caused by anemia. Anemia is a frequent complication of chronic kidney disease that occur earlier than other complications of CKD and almost occurs in all patients with CKD on HD. Anemia occurs in 80-90% of CKD patients and significantly increase the risk of morbidity and mortality in CKD patients.²

Adequacy of hemodialysis is an important factor in reducing the morbidity and mortality of hemodialysis patients. The most commonly used markers for dialysis

adequacy are Kt/V and Urem Reduction Rate (URR). K refers to dialyzer's clearance level of how much blood is flowed into the dialyzer (mL/min), t is the processing time for each hemodialysis (in minutes) and V is the volume of fluid in the patient's body, while URR is a comparison of ureum before and after hemodialysis treatment. The Indonesian Renal Registry (IRR), 2018 shows that only 19% have achieved the Kt/V target (adequate) and an adequate URR is only 12% of patients. The incidence of anemia is still very high in CKD on HD patients. Umakhan's research in India (2018) shows that 100% of patients who routinely undergoing hemodialysis had anemia. Meanwhile in Indonesia in 2017, the IRR showed 77% of CKD on HD patients had anemia, and in 2018 it actually increased to 78%. Anemia is one of the important clinical conditions of dialysis patients and the guide for anemia management in Indonesia uses a hemoglobin (Hb) limit of 10 mg/dL to obtain supportive therapy.³

Panagoutsos, (2009)⁴ said that by increasing the Kt/V value from 0.93 ± 0.19 to 1.55 ± 0.29 , it could statistically increase the HB value from 10.4 ± 1.7 to 11.0 ± 1.3 g / dL ($p < 0.05$). In line with this study, Sheikh, M-El (2016)⁵ in his study found that there was a positive correlation between HD adequacy and control of blood pressure, nutritional status and the incidence of anemia ($P = 0.00$). This is different from Hasanzamani (2020) in his study of 57 CKD patients who undergoing hemodialysis found that 65% of them had anemia with 50% HD adequate achievement and no significant correlation was found between HD adequacy and anemia prone rate ($p > 0.05$). Likewise, the research of Aghsaiefard (2018), in the Soodeh hemodialysis center which was conducted on 176 patients, found that HD adequacy was not correlated with anemia.

From previous studies, it is known that there are studies that show a significant relationship between adequate hemodialysis and anemia, but other studies have found the opposite. Thus, this study aimed to find the result whether there is or is not correlation between adequate hemodialysis and anemia, regarding the characteristic participant covariates. And to find any circumstances related to anemia within hemodialysis patients in Fatmawati Hospital.

At dialysis unit of Fatmawati Hospital the average achievement of adequate HD was only 52.7% and the rate of anemia (HB level less than 10 mg/dl) was 56.5%. In this study, the researcher wanted to test whether the high incidence of anemia in CKD patients who undergoing HD had a significant relationship with the achievement of hemodialysis adequacy which tended to be low.

Knowing the analysis of the relationship between the achievement adequacy of hemodialysis with the incidence of anemia in patients with CKD on HD.

METHODS

This study was conducted on patients who routinely undergoing hemodialysis therapy, by taking the sample using purposive sampling technique and obtained 134 respondents who met the study inclusion criteria. The method used in this research is quantitative by using a descriptive correlation research design with a cross sectional approach for the analysis of the independent variable (HD Adequacy) and the dependent variable (Anemia). HD adequacy was measured by Kt/V and URR. For adequate hemodialysis it is called to be adequate if the Kt/V value is ≥ 1.8 (HD 2 times a week) or $Kt/V \geq 1.2$ (HD 3 times a week). URR is adequate if $\geq 65\%$ (HD 2 times a week) and $\geq 80\%$ (HD 3 times a week). While anemia was determined by HB values < 10 mg/dl. The relationship between these variables was tested using the Chi Square test.

This study focuses on controlling variables to maximize the variance of variables related to the research hypothesis, minimizing the variance of confounding variables that may affect the results, but are not the aim of the study.

RESULTS

The total subjects in this study were 134, with the characteristics of the research subjects show in Table 1.

Table 1. Distribution of Characteristics of Research Subjects in the Dialysis Unit, Fatmawati Hospital

Subject Characteristics	All Subject	HD 2 times /week	HD 3 times /week
Total Subject	134 (100%)	110 (82.1%)	24 (17.9%)
Age (years)	53 (13-86)	53 (13-86)	52 (35-71)
Comorbid Disease			
Hypertension	63(46.8%)	51 (46.2%)	12 (54.5%)
DM	56 (41.7%)	47 (42.3%)	9 (36.4%)
Others (glomerulonephritis, malignancy, urinary tract stones, etc.)	15 (11.5%)	12 (11.5%)	2 (9.1%)
Vascular access			
CDL Jugularis	24 (28.7%)	21(30.8%)	3(9.1%)
AV Fistula	110 (68.7)	99 (67.3%)	21 (81.8%)
HD Length (Year)	3.5 (0.33-12.8)	4.1(0.33-12.8)	2.9 (0.8-5.1)
Gender			
Women	74 (55.2%)	66	8
Men	60 (44.8%)	44	16

Hemodialysis adequacy was measured by 2 methods, namely Kt/V and URR. The results show in the table below.

Table 2. Distribution of HD Adequacy Achievement (Kt/V) in the Dialysis Unit of Fatmawati Hospital

Kt/V	All Subject 1.67 (1.03-2.75)		HD 2 times / week 1.74 (1.03-2.75)		HD 3 times / week 1.45 (1.13-1.92)	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Inadequate	61	45.5%	60	54.5%	1	4.2%
Adequate	73	54.5%	50	45.5%	23	95.8%
Total	134	100%	110	100%	24	100%

The table above, shows that the HD adequacy as measured by Kt/V Daugirdas in the Dialysis Unit Fatmawati Hospital is at 1.03-2.75 with a mean value of 1.67 and most of them have adequate values (54.5%), especially for patients undergoing hemodialysis 3 times per week had an adequate value of 95.8%.

Table 3. Distribution of HD Adequacy Achievement (Kt/V) in the Dialysis Unit of Fatmawati Hospital

URR	All Subject 75.13 ± 6.38		HD 2 times / week 76.08±5.87		HD 3 times / week 70.75±6.91	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Inadequate	26	19.4%	4	3.6%	22	91.7%
Adquate	108	80.6%	106	96.4%	2	8.3%
Total	134	100%	110	100%	24	100%

The mean HD adequacy value measured by URR was at 75.13 ± 6.38%, where from all subject 80.6% was adequate, but in patients who undergoing HD 3 times only 8.3% had adequate URR (URR ≥80%)

Table 4. Distribution of Anemia (HB <10 mg/dl) in the Dialysis Unit Of Fatmawati Hospital

Hb Value (mg/dl)	All Subject 8.93±2.82		HD 2 times / week 8.75±2.92		HD 3 times / week 9.8±2.17	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Negative Anemia	62	46.3%	45	40.9%	17	70.8%
Positive Anemia	72	53.7%	65	59.1%	7	29.2%
Total	134	100%	110	100%	24	100%

Most of the patients undergoing hemodialysis at Fatmawati Hospital had anemia (Hb less than 10 mg/dl), which was 53.7%, with an average Hb value of 8.93 ± 2.82 mg / dl.

Table 5. Cross Table of Correlation Distribution Adequacy of Hemodialysis (Kt/V) with Anemia in the Dialysis Unit, Fatmawati Hospital

		All Subject				HD 2 times / week			HD 3 times / week				
		Kt/V		Σ	P	Kt/V		Σ	P	Kt/V		Σ	P
		Inadequate	Adequate			Inadequate	Adequate			Inadequate	Adequate		
Status Anemia	Positive Anemia	35	41	76	0.670	34	31	65	0.571	0	7	7	0.512
	Negative Anemia	26	32	58		26	19	45		1	16	17	
Total		61	73	134		60	50	110		1	23	24	

From the table above, it can be seen that the results of the analysis of the Chi Square test of HD adequacy calculated with Kt/V and its correlation with the anemia rate in CKD patients undergoing hemodialysis. In all subject and those with HD 2 times per week, on adequate or inadequate HD, the incidence of anemia was similarly higher than those without anemia (41 and 35 vs 32 and 26, 31 and 34 vs 19 and 26). But for samples with HD 3 times per week, the incidence rate of anemia is lower than those without anemia, it means

that the more often patients undergo HD, the less anemia. From the three sample groups, it is seen that the P value is > 0.05, that indicates there is no significant relationship between the achievement of HD adequacy (Kt/V) and anemia.

The measurement of HD adequacy with URR and its correlation with the incidence of anemia also showed almost the same results. Details can be seen in the table below:

Table 6. Cross Table of Correlation Distribution Adequacy of Hemodialysis (URR) with Anemia in the Dialysis Unit, Fatmawati Hospital

		All Subject				HD 2 times / week			HD 3 times / week				
		URR		Σ	P	URR		Σ	P	URR		Σ	P
		Inadequate	Adequate			Inadequate	Adequate			Inadequate	Adequate		
Status Anemia	Positive Anemia	9	63	72	0.217	3	62	65	0.510	6	1	7	0.498
	Negative Anemia	17	45	62		1	44	45		16	1	17	
Total		26	108	134		4	106	110		22	2	24	

The table above shows that in all subjects, 62 patients who were absence of anemia, 45 of them were in patients who underwent adequate HD (URR). Likewise, the study subjects who underwent hemodialysis twice and three times per week, found that the incidence of non-anemia in hemodialysis patients was higher in adequate URR. But of

all groups of study subjects the P value is > 0.05, which means there is no significant correlation between URR and the incidence of anemia. The incidence of anemia (72) was higher in patients undergoing HD with adequate URR compared to those in inadequate HD⁹.

DISCUSSION

Anemia is a common problem that often occurs in patients with CKD on HD. Many factors contribute to anemia in patients with CKD on HD. The American Nephrology Nurses Association (ANNA), 2013 said that the causes of anemia in CKD patients include; inadequate erythropoietin (EPO) production, shortened age of red blood cells due to uremia or other toxins, blood loss in the hemodialysis process, blood sampling for routine lab tests, gastrointestinal bleeding, iron deficiency, nutritional and vitamin deficiencies. Anemia that occurs in patients with CKD on HD caused the quality of life for HD patients to be low. Quality of life for HD patients is closely related to good

HD adequacy. One of the manifestations/clinical criteria for adequate dialysis is the absence of anemia. This is consistent with several studies which stated that there was a significant relationship between HD adequacy and anemia (Panagoutsos, 2009 and Sheikh, M-El, 2016), but there were also researchers who found no significant relationship between HD adequacy and anemia (Hasanzamani, 2020 and Aghsaiefard, 2018). The differences in the results of these studies indicate that many factors contribute to anemia.

Although there is no significant relationship, the Chi square test results show that there is a positive relationship between HD adequacy and anemia. If we pay attention on it, the more adequate hemodialysis is, the lower anemia is.

Table 7. Comparison of The Incidence of Non-Anemia and Anemia In Adequate and Inadequate Kt/V

All Subject		Hemodialysis Adequacy Kt/V			
		Inadequate		Adequate	
Status Anemia	Positive Anemia	35	0.74	41	0.78
	Negative Anemia	26		32	
Total		61		73	

From the table above, shows that in adequate Kt/V the ratio that was negative and positive anemia was 0.78 and for inadequate Kt/V the ratio that was 0.74. This comparison shows that the percentage of patients who are negative anemia is greater than those with anemia in HD with adequate Kt/V. This means that the higher the Kt/V result the higher the Hb value, on the other hand, a low Kt/V indicate anemia.

The high incidence of anemia in patients undergoing hemodialysis therapy is a trigger for researchers to determine the factors that influence the occurrence of anemia. The focus of this research is on the relationship between HD adequacy and the incidence of anemia.

In this study, the incidence rate of anemia was 53.7%. This high number is supported by demographic data which shows that the age reaches 86 years. A study conducted on 3341 hemodialysis patients found that elderly patients had lower hemoglobin levels (Hb <9 mg/dl) than patients who had not entered old age (Hb ≥ 9 mg/dl) with a P value = 0.045.⁶

Gender also affects anemia. Generally, female patients have lower Hb values due to menstrual cycles and lower nutrient intakes. Hormonal differences between men and women also cause a higher tendency of anemia in women.⁷ In this study, it was found that the demographic data of women (55.2%) were higher than that of men, and if further analyzed, the anemia rate in female patients was also higher than in male patients (74 vs 60).

CDL access also had a greater influence on the occurrence of anemia in hemodialysis patients. Inflammation and infection often occur in patients with CKD on HD who have vascular access in the form of CDL. In this study, if analyzed further, it was found that patients with CDL access had a higher percentage of the incidence of anemia compared to patients who had access to cimino (AV shunt) (56.5% vs 52.7%).

The Kidney Disease Improving Global Outcomes (KDIGO), 2012, explains that erythropoiesis stimulating agent therapy is used to maintain Hb at 9-10 mg/dl, not below 9 mg/dl or more than 11.5 mg/dl. Erythropoiesis-stimulating agents (ESA) are medications which stimulate the bone marrow to make red blood cells. They are used to

treat anemia due to end stage kidney disease. Hb levels less than 9 mg/dl leads to low quality of life, fatigue, lethargy, decreased body function. Anemia also requires blood transfusions which have possible complications such as increasing the risk of iron overload, infection and result in delayed kidney transplantation. On the other hand, an Hb value greater than 13 mg / dl lead to the risk of stroke, hypertension and thrombosis in access vascular hemodialysis. Therefore, the ESA dose is given to maintain the Hb value in the range 10-11.5 mg/dl.⁸

According to the ANNA, the main cause of anemia in CKD on HD patients is deficiency of erythropoietin (EPO), in this study the high rate of anemia (56.7%) in the dialysis unit Fatmawati Hospital was also caused by insufficient production of EPO by the kidneys and 95% hemodialysis patients at Fatmawati Hospital received 3000 units of routine ESA therapy according to the incidence of anemia. ESA therapy is consistent with the presentation of anemia. ESA therapy provides good benefits by reducing signs and symptoms of anemia.

Although the administration of ESA provides a decrease in the percentage of anemia in hemodialysis patients, it turns out that 10% -20% of patients are resistant to the effects of ESA therapy.¹⁴ This also supports the cause of anemia, which is still high even though ESA therapy has been given. In addition, the patient's hypertensive condition may result in the provision of ESA therapy to be postponed to prevent further increase in blood pressure. On the other hand, giving anti-hypertensive therapy, especially the complex angiotensin-converting-enzyme (ACE) inhibitor therapy suppress erythropoiesis.

However, the limitation of this study is that it does not seek to correlate other confounding variables with anemia. In addition, in this study the measurement of HD adequacy (Kt/V, URR) and anemia was only performed once, whereas HD adequacy and anemia were not only talking about numbers, but were concepts related to the quality of life of hemodialysis patients. To be able to describe the true hemodialysis adequacy, Kt/V and URR measurement data should be carried out several times continuously in a certain time.

CONCLUSION

In this study, there was no significant relationship between HD adequacy and the incidence of anemia, but there was a tendency for the data to show that adequate HD would increase the Hb value.

CONFLICT OF INTEREST

None declared.

FUNDING SOURCES

None.

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