DOI: https://doi.org/10.53350/pjmhs22163662

ORIGINAL ARTICLE

Description of Iron Status In Chronic Kidney Disease (CKD) Stadium 5 with Regular Hemodialization at the Hemodialysis Installation of Dustira Hospital

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ABSTRACT

Introduction: The number of patients with chronic kidney failure in Indonesia continues to increase and is estimated to grow by around 10% every year. Decreased of haemoglobin (Hb) in patients with CKD almost occurs in 80% of cases.

Aim: The purpose of this study was to describe the iron status of patients with chronic kidney disease stage 5 undergoing regular hemodialysis.

Methods: The study conducted is a descriptive study with a cross-sectional design to describe the iron status of stage 5 CKD patients undergoing regular hemodialysis at the Hemodialysis Installation of the Dustira Cimahi Hospital. Data used are secondary data from the medical records of stage CKD patients. 5 at the Hemodialysis Installation. Univariate analysis is performed by presenting data in terms of frequency and percentage or mean and standard deviation.

Result: Patients in this study had a mean age of 46.75 years, a median age of 45 years (range: 18-71 years), and as many as 28 people were in the 37-45 year age group (range: 18-71 years) who underwent regular hemodialysis (35.0 percent). The majority of CKD stage 5 patients who had regular hemodialysis were female, with as many as 44 out of 80 patients being female (55.0 percent). In this study, 80 patients with CKD stage 5 were found to have decreased serum iron (66.3%) with a normal value range of 65-165 g/dl, TIBC decreased (43.8%) with a normal value range of 300 -360 g/dl, and transferrin saturation decreased (50%) with a normal range of 20-50%. Based on the serum iron, patients with CKD stage 5 who underwent regular hemodialysis had a mean serum iron of 56.53 g/dl)] and most of them had decreased serum iron, as many as 53 people out of 80 people (66.3%).

Conclusion: The percentage of patients with chronic kidney disease stage 5 who underwent regular hemodialysis who experienced iron deficiency was 11.0% and did not have iron deficiency was 89.0%. The mean serum Fe, TIBC and TSAT levels of patients with chronic kidney disease stage 5 undergoing regular hemodialysis were 56.53 g/dL, 277.64, g/dL, and 23.10%, respectively.

Keyword: Chronic Kidney Disease; Hemodialysis; Iron Status

INTRODUCTION

Chronic kidney disease (CKD) is a term that includes all levels of decreased kidney function from mild, moderate, and severe chronic kidney damage. CKD is a public health problem worldwide. An increase in the incidence and prevalence of renal failure with poor outcome and high costs has occurred in many countries.[1,2] Chronic Kidney Disease (CKD) is more common in the elderly population, younger patients usually have a progressive decline in kidney function, 30% of patients >65 years of age with CKD have stable disease.[1,3]

The number of patients with chronic kidney failure in Indonesia continues to increase and is estimated to grow by around 10% every year.[4,5] Data from Ministry of Health (MoH) of Indonesia shows that the number of people with kidney disease in Indonesia ranks second after heart disease, with almost 100 percent growth in the period 2014-2015. Most of the population affected by kidney disease is of productive age. Data from the 7th Report of the Indonesian Renal Registry in 2014 shows that 56 percent of people with kidney disease are people of productive age, which are under 55 years of age.[4,6]

Decreased of haemoglobin (Hb) in patients with CKD almost occurs in 80% of cases. The causes are multifactorial, including deficiency of erythropoietin production, a circulating factor that appears to inhibit erythropoietin, shortened red blood cell half-life, increased gastrointestinal blood loss due to thrombocytopenia, folic acid and iron deficiency, and blood loss from hemodialysis or laboratory test samples.[7] Although all the factors listed can play a role in the decrease in Hb, erythropoietin deficiency is believed to be the main cause.[8,9]

In one study, it was proven that hemodialysis patients could lose an average of 4.6 L/year of blood. Gastrointestinal blood loss, often taken for laboratory tests and folic acid deficiency can also cause anemia. Iron homeostasis appears to be impaired in chronic kidney disease.[10,11]

The serum ferritin, TSAT, and TIBC are the three most important measures of iron status. Both the serum ferritin concentration and the transferrin saturation are measured and used to target anaemia therapy in patients with chronic kidney disease (CKD). They are also connected with clinical outcomes in patients receiving dialysis treatment.[13] The purpose of this study was to describe the iron status of patients with chronic kidney disease stage 5 undergoing regular hemodialysis.

MATERIAL AND METHODS

The study conducted is a descriptive study with a cross-sectional design to describe the iron status of stage 5 CKD patients undergoing regular hemodialysis at the Hemodialysis Installation of the Dustira Cimahi Hospital from September 2017 – November 2017. The data used are secondary data from the medical records of stage CKD patients. 5 at the Hemodialysis Installation at Dustira Cimahi Hospital.

This study involved the medical records of patients diagnosed with CKD stage 5 who underwent regular hemodialysis and had complete serum iron and TIBC results. The variables used in this study were patients who had been diagnosed with CKD stage 5 who underwent regular hemodialysis and had data on serum iron and TIBC results. Univariate analysis is performed by presenting data in terms of frequency and percentage or mean and standard deviation. This study did not require informed consent.

RESULT

Patients with chronic kidney disease stage 5 who underwent regular hemodialysis at the Hemodialysis Installation at Dustira Cimahi Hospital had a mean age of 46.75 years, a median age of 45 years (range: 18-71 years), and as many as 28 people were in the 37-45 year age group (range: 18-71 years) who underwent regular hemodialysis (35.0 percent). The majority of CKD stage 5

patients who had regular hemodialysis were female, with as many as 44 out of 80 patients being female (55.0 percent).

Table 1: Characteristics of subjects based on age, gender, and etiology

Age Group (y.o.)	Sex		Etiology					
	Male	Female	HKD	DKD	HKD + DKD	Glomerulo-pathy	Obstructive	Other
18-27	4 (66,7)	2 (33,3)	2 (33,3)	0 (0)	2 (33,3)	2 (33,3)	0 (0)	0 (0)
28-36	5 (55,6)	4 (44,4)	5 (55,6)	0 (0)	0 (0)	3 (33,3)	1 (11,1)	0 (0)
37-45	14 (50,0)	14 (50,0)	17 (60,7)	2 (7,1)	0 (0)	6 (21,4)	3 (10,7)	0 (0)
46-54	3 (21,4)	11 (78,6)	10 (71,4)	3 (21,4)	1 (7,1)	0 (0)	0 (0)	0 (0)
55-63	7 (43,3)	9 (56,7)	5 (71,5)	1 (14,3)	0 (0)	2 (12,5)	2 (12,5)	1 (6,3)
64-72	3 (42,9)	4 (57,1)	5 (71,4)	1 (14,3)	0 (0)	0 (0)	0 (0)	1 (14,3)

Table 2: Description of the iron status of patients with CKD stage 5

Variable	Mean (SD)	Category Iron Profile Status					
		Low		Normal		High	
		n (%)	Mean (SD)	n (%)	Mean (SD)	n (%)	Mean (SD)
Iron serum (µg/dl)	56,5	53 (66,3)	40,8 (12,2)	27 (33,8)	87,2 (17,3)	0	0
TIBC (µg/dl)	277,6	35 (43,8)	189,1 (23,9)	30 (37,5)	291,7 (42,1)	15 (18,8)	434,9 (56,9)
TSAT (%)	23,1	40 (50)	12,9	38 (47,5)	30,6	2 (2,5)	84,3

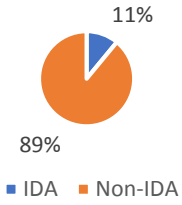

Figure 1: Iron Status Overview Percentage

In this study, 71 people (89.0%) were not iron deficient and 9 (11.0%) had iron deficiency assessed from serum iron, TIBC, and transferrin saturation, with deficiency criteria, namely if serum iron decreased (<65 µg/dL), TIBC increased (>360 µg/dL), and transferrin saturation decreased (<20%).

In this study, based on medical record data, 80 patients with CKD stage 5 were found to have decreased serum iron (66.3%) with a normal value range of 65-165 g/dl, TIBC decreased (43.8%) with a normal value range of 300 -360 g/dl, and transferrin saturation decreased (50%) with a normal range of 20-50%. Based on the serum iron, patients with chronic kidney disease stage 5 who underwent regular hemodialysis had a mean serum iron of 56.53 g/dl)] and most of them had decreased serum iron, as many as 53 people out of 80 people (66.3%).

DISCUSSION

Study shows that the largest age group is 37-45 years, namely 28 people. Hengkesa et al also showed the same thing, where CKD mostly occurred in the 40-49 year age group.[14] This age is included in the age that is prone to degenerative diseases, such as diabetes, hypertension, and other diseases that trigger the occurrence of chronic kidney failure. chronic kidney disease compared with patients aged <60 years.[15] This study was dominated by female gender (55.0%). Felix et al also showed that there were more female samples (53.8%).[16]

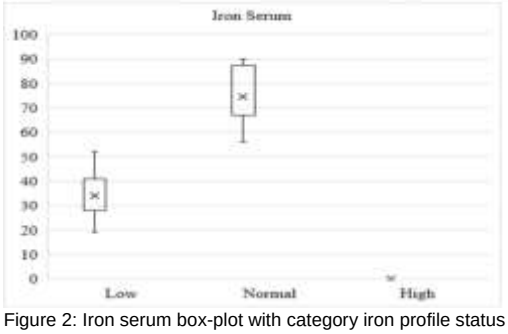

Figure 2: Iron serum box-plot with category iron profile status

Based on the etiology, it was found that most of the research subjects had HKD (hypertension kidney disease), namely 52 out of 80 people, with 3 people having a combination of two etiologies of chronic kidney disease, namely HKD and DKD (diabetic kidney disease). Pranandari et al also stated that there was a significant relationship between hypertension and the incidence of chronic kidney disease undergoing hemodialysis.[15] Data collected by in 2011 stated that hypertension was the most common etiology, namely 34% of chronic kidney disease. Hypertension is one of the causes of CKD through a process that results in the progressive and irreversible loss of a large number of functional nephrons.[6],[19]

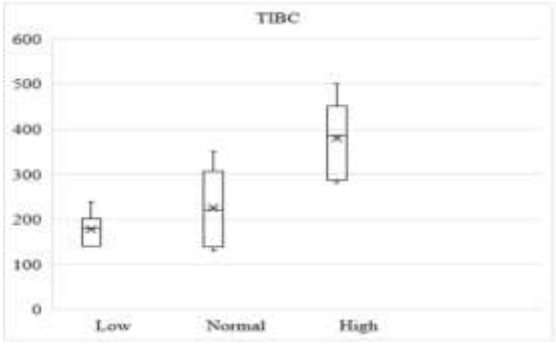

Figure 3: TIBC box-plot with category iron profile status

While in IDA, the amount of iron stored in the body determines how much iron is available for use, in function iron deficiency (iron limited erythropoiesis), the amount of iron available is determined by the pace at which iron is mobilised from the reserves. Iron deficiency or functional iron deficiency may be difficult to diagnose in people with acute or chronic inflammatory disorders. Recombinant human erythropoietin (rHuEpo) has been approved for the treatment of anaemia associated with renal illness.[10–12]

The study showed that the most patients with decreased serum iron (66.3%) with a normal value range of 65-165 g/dl, decreased TIBC (43.8%) with a normal value range of 300-360 g/dl, and decreased transferrin saturation. (50%) with a normal value range of 20-50%. Stage 5 CKD patients undergoing regular hemodialysis had a mean serum iron of 56.53 g/dl]] and most of them had decreased serum iron, as many as 53 out of 80 people (66.3%).

Another study showed that patients with serum Iron: 81.38 ± 14.12 ng/mL, TIBC: 249.8 ± 71.41 ng/ml, TSAT: 33.84 ± 23.50%, ferritin: 709.1 ± 375. Ng/mL. The rate was higher in those without hemodialysis, but lower than in those who received a kidney transplant.[20] Another study showed that patients with serum iron serum: 80.26 ± 11.04, TIBC : 232.48 ± 32.14, ferritin: 698.80 ±

74.04, TSAT. The rate was higher in those without hemodialysis, but lower than control. Although the difference is not significant.[21]

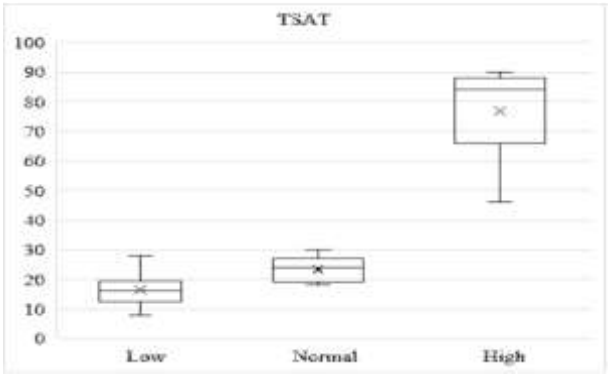

Figure 4: TSAT box-plot with category iron profile status

Rafi (2007) evaluated the accuracy of two commonly used tests, transferrin saturation (TSAT) and serum ferritin levels, in assessing and monitoring body iron stores. They studied 24 regular hemodialysis patients receiving regular erythropoietin therapy over a 12-month period. According to the TSAT and serum ferritin readings, patients were categorised as normal, deficient, undetermined, or overloaded. Iron status could be assessed in 16 (67%) patients using TSAT and serum ferritin; 12 (50%) had acceptable (or normal) iron status, three (12.5%) had iron deficiency, and one (4.2%) had iron excess.[22]

Based on the TIBC description, patients with chronic kidney disease stage 5 who underwent regular hemodialysis had an average TIBC of 277.64 g/dl and most of them had a decreased TIBC as many as 35 people out of 80 people (43.8%). Decreased total iron binding capacity can occur in anemia of chronic disease that is inflammatory due to an increase in ferritin. The Iron Disorders Institute states that a low TIBC indicates an adequate amount of iron (ferritin) stores, but not enough available in the blood circulation (serum iron), while a TIBC that tends to increase indicates a decreased iron store.[17,18]

Previous studies have shown that iron and TIBC levels in patients with CKD undergoing hemodialysis are low, while ferritin levels are in the high group. In chronic inflammatory disorders such as chronic infections, cancer, and autoimmune diseases, ACD is the most common type of anaemia seen in hospitalised patients. ACD is associated with a low serum iron concentrations inside the case of excessive reticuloendotelial iron stores; it is a hypoproliferative anaemia. It has been suggested that cytokines have a role in the ACD, with increased iron storage in the reticuloendothelial leading to hyposideremia.[10–12]

That treatment leads in functional iron shortage as a consequence of inadequate iron reserves to support the increased erythropoiesis caused by the therapy. When it comes to dialysis patients, iron shortage is the most common reason for a poor response to erythropoietin. Noncompliance, gastrointestinal side effects, poor absorption, and medication interaction are all factors that limit the effectiveness of long-term orally given iron treatment; intravenous iron compounds are used to treat dialysis patients who become iron deficient.[11,12]

Iron deficiency can be caused by blood loss and poor gastrointestinal absorption (antacids given in hyperphosphatemia also bind iron in the intestine). In addition, the hemodialysis process can cause a loss of 3-5 grams of iron per year. Normally, we lose 1-2 mg of iron per day, so iron loss in dialysis patients is 10-20 times more. The life span of erythrocytes in patients with renal failure is only about half of that of normal erythrocytes.[11,12]

This increase in erythrocyte hemolysis appears to be due to abnormalities in the plasma chemical environment and not to defects in the blood cells themselves. Hemolysis in terminal renal failure is moderate. In chronic hemodialysis patients, the lifespan of erythrocytes measured using Cr showed a variation from normal red blood cells that lived but the mean survival time was reduced by 25-30%.[11,12]

A study including thirteen pools of blood from hemodialysis and nonhemodialysis patients, researchers discovered intermethod differences of up to 150 ng/ml when they compared six routinely used ferritin tests. A study of 60 stable hemodialysis patients found that the intraindividual variability for ferritin was between 2 and 62 percent when assessed during an initial two-week period, and between 3 and 52 percent when examined over a six-week period.[24] In chronic renal failure, a significant reduction in TIBC and ferritin levels is associated with a chronic inflammatory disease or tumours, as well as proteinuria.[17]

Inverse connection between ferritin and transferrin levels implies that increased ferritin synthesis may compensate for lower levels of iron-bound transferrin, which decreases the amounts of iron status present in the bloodstream. Ferritin levels in hemodialysis patients should be checked on a regular basis to ensure that they do not become iron deficient and that their ferritin value does not continue to rise.[17]

Long-term hemodialysis may produce erythropoietin deficit due to faulty iron supplies, while faulty iron supplies can cause iron deficiency due to faulty iron supplies When the transferrin binding capabilities of iron medications are exceeded, as well as when the quantity of non-transferrin reactive iron in the plasma rises, undesirable consequences might occur.[17]

Anemia or status iron make a signifficant impact for patient with CKD. Patients getting inappropriately low ESA given dosages under the bundled payment system were shown to have a greater risk of mortality if their haemoglobin level was lower (<10 g/dL) for a longer period of time. An elevated serum ferritin level of <300 ng/mL was linked with a greater risk of all-cause and cardiovascular mortality, whereas an elevated serum ferritin level of more than 800 ng/mL was associated with a higher risk of all-cause and infectionrelated death.[27]

CONCLUSION

The percentage of patients with chronic kidney disease stage 5 who underwent regular hemodialysis at the Hemodialysis Installation of Dustira Cimahi Hospital who experienced iron deficiency was 11.0% and did not have iron deficiency was 89.0%. The mean serum Fe, TIBC and TSAT levels of patients with chronic kidney disease stage 5 undergoing regular hemodialysis were 56.53 g/dL, 277.64, g/dL, and 23.10%, respectively.

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