Original Article

Sarcopenia in Dialysis Patients: Correlation with Haemoglobin and Creatinine Levels

Sarcopenia in Dialysis Patients

Natalia Hariyanti, Ahmad Syauqy and Etika Ratna Noer

ABSTRACT

Objective: To analyse association among sarcopenia also haemoglobin as well as creatinine levels at patients undergoing haemodialysis.

Study Design: Cross-sectional study.

Place and Duration of Study: This study was conducted at the KRT Setjonegoro Wonosobo Hospital for 7 months in December 2023 to July 2024.

Methods: Research used a cross-sectional design, conducted at KRT Setjonegoro Wonosobo Hospital in December 2023. Sample of 83 respondents was selected utilizing consecutive sampling technique. Instruments used were BIA, handgrip strength dynamometer, and stopwatch to determine sarcopenia parameters and biochemical results before haemodialysis to see haemoglobin and creatinine levels. Data collected were tested using the Mann Whitney test.

Results: There were 19 out of 83 respondents experienced sarcopenia (22.9%), there was a correlation of sarcopenia in haemodialysis patients in terms of haemoglobin levels (p=0.024), and there was a correlation of sarcopenia in haemodialysis patients in terms of creatinine levels (p=0.043).

Conclusion: There is big corelation among haemoglobin also creatinine levels as well as the incidence sarcopenia at patients undergoing haemodialysis.

Key Words: Chronic Kidney Disease, Creatinine, Haemodialysis, Haemoglobin, Sarcopenia

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INTRODUCTION

Chronic Kidney Disease (CKD) remains a condition characterized by chronic kidney disease that lasts three months or longer. CKD is characterized by a gradual and irreversible loss of kidney tissue, with or without kidney damage, and is characterized by a Glomerular Filtration Rate (GFR) below 60 mL/min/1.73 m² for more than three months[1]. End Stage Renal Disease (ESRD) is the last stage of CKD also is characterized by extremely poor renal function; patients at this stage require permanent renal replacement therapy, such as dialysis or kidney transplantation[2]. ESRD patients require renal replacement therapy to support their quality of life. This is because the failure of kidney function in the final stage can result in abnormalities in the body's electrolytes and can form toxins in the bloodstream. Kidney replacement therapy that can be done is by kidney transplantation or by dialysis.

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There are two types of dialysis that are often used, namely peritoneal dialysis and haemodialysis (HD)[3]. Sarcopenia is common in ESRD patients undergoing dialysis[4]. Declining muscular strength and/or physical performance accompanied by a gradual decrease of skeletal muscle mass is known as sarcopenia, and it is a common age-related clinical disease[5]. Sarcopenia caused by many factors, mainly physical inactivity and ageing. Other factors include low calorie and protein intake, decreased anabolic hormones (testosterone, IGF-1, DHEA, GH), increased inflammatory cytokines, and reduced blood flow to the muscles[6]. Sarcopenia occurs with advancing age, but can also develop in young adults[7]. Sarcopenia is categorised into primary sarcopenia (caused by the ageing process), secondary sarcopenia (associated with bed rest, sedentary life style, zero-gravity conditions, and organ failure diseases such as heart, liver, kidney), and nutrient intake-related sarcopenia (caused by inadequate energy and protein intake due to malabsorption, gastrointestinal disorders, and use of drugs that cause anorexia)[8]. The prevalence of sarcopenia in non-dialysis CKD patients ranges from 5.9-9.8% also in dialysis patients is reported to be higher at 20-42.2%.[9] Other studies mentioned from 25.9-34.6%[4]. Meanwhile, the prevalence of sarcopenia using the SARC-F assessment was 30% also prevalence of severe sarcopenia ranged by 18% till 35%[10]. Variations in the prevalence of sarcopenia in CKD depend on the method

also cut-off applied as well as the diagnosis criteria used[9].

Haemoglobin is a significant biomarker for sarcopenia, with diagnostic and prognostic uses[11]. There seems to be a correlation between haemoglobin and physical performance, strength of muscles, and muscle mass in chronic kidney disease patients, according to research. A loss of hunger, anaemia, metabolic acidosis, and other systemic symptoms are all part of chronic renal failure. A loss of muscle mass also an overall decline at physical performance may be attributed to all of these disorders[12]. Creatinine is another potential biomarker of sarcopenia characteristics in dialysis patients that may be seen in test results. A dependable predictor of a person's muscle mass and function, serum creatinine levels are frequently evaluated at ESRD patients on dialysis[13]. A lower blood creatinine level suggests muscle atrophy and an elevated risk of death, while a higher creatinine level is related with a lower risk of death[14].

According previous studies on correlation among haemoglobin also creatinine to incidence sarcopenia in haemodialysis patients, researchers consider this study important to understand how haemoglobin and creatinine levels can make risk of sarcopenia at dialysis patients so that it can be the basis for better prevention and management efforts to improve patients life quality.

METHODS

Model of research was analytical observational by a cross-sectional model. Ethical Clearence of study has been approved by KEPK of the Faculty of Medicine, Diponegoro University Semarang with ethical code number: 567/EC/KEPK/FK-UNDIP/XI/2023. The collection of independent variables and dependent variables was carried out on the day the patient arrived, during dialysis, until the patient was discharged. The study was conducted in the haemodialysis unit of KRT. Setjonegoro Wonosobo Hospital. The inclusion criteria in this study were male and female outpatient haemodialysis patients who had a minimum age of 20 years, a length of haemodialysis ≥ 3 months, agreed to be a research subject by filling in and signing the informed consent that had been provided, and the patient was still doing daily activities. A total of eighty-three patients were sampled. We used a sequential sampling method, which entails selecting a sample from all participants who fulfilled the study's inclusion criteria up to a certain time point, and then screening them if necessary.

The research instruments used were a stepped weight scale and microtoa from TANITA WB-380, LLA tape from OneMed, BIA (Bioelectrical Impedance Analysis) from Omron HBF-375, hand grip strength dynamometer from Camry EH-101, informed consent, and stopwatch from Q&Q MF01J. The collected data were then analysed univariate and bivariate using statistical tests. Data analysis utilizing IBM SPSS Statistic 27.0.1.0 64-bit edition software. Data normality test and characteristic test were conducted before data analysis. The data normality test used Kolmogorov Smirnov. Univariate analysis utilized for describing the frequency of each variable. Bivariate analysis used Chi Square statistical test for categorical data also Mann Whitney statistical test by numerical data that were not normally distributed.

RESULTS

Table 1 shows the results of the socio-demographic data, which includes the frequency of variables of gender, age, length of haemodialysis, and sarcopenia. Table 2 shows the results of the analysis of the relationship between sarcopenia and the independent variables in the study, namely haemoglobin and creatinine levels.

Table No.1: Socio-demographic data of respondents (N = 83)

Variables	Not Sarcopenia	Sarcopenia	P value	Amount
Gender				
Male	31	11	0.469	42 (50.6)
Female	33	8		41 (49.4)
Age Category				
Late adolescence (17-25 years old)	3	2	0.789	5 (6)
Early adulthood (26-35 years old)	7	2		9 (10.8)
Late adulthood (36-45 years)	16	4		20 (24.1)
Early elderly (46-55 years)	18	3		21 (25.3)
Late elderly (56-65 years)	16	6		22 (26.5)
Elderly (≥ 66 years)	4	2		6 (7.2)
Length of HD Category				
New (< 12 months)	28	6	0.542	34 (41)
Fair (12-24 months)	19	8		27 (32.5)
Old (>24 months)	17	6		23 (26.5)
Sarcopenia	64 (77.1)	19 (22.9)		

Table No.2: Relationship between Haemoglobin and Creatinine with the Incidence of Sarcopenia

Variables	Not Sarcopenia	Sarcopenia	P value
Haemoglobin (g/dL)	8.1 (4.3 – 11.5)	8.9 (7.2 – 11.3)	0.024
Creatinine (mg/dL)	11.71 (4.96 – 18.87)	13.12 (5.9 – 17.39)	0.043

DISCUSSION

In this research, commonly of participant were male with total 42 (50.6%), while female respondents totalled 41 people (49.4%). Factors that may influence this are unhealthy living habits that men often have, such as smoking, consuming coffee, alcohol, and certain supplements that can reduce kidney function[15]. On the other side, women have a lower risk of developing chronic kidney disease than men because sexual hormones play a role in protecting kidney function. Oestrogen in women has a protective effect on the development of kidney disease, especially on the nephron component, glomerulosclerosis, and fibrosis[16]. In this study, Late Elderly age group 56-65 years was the largest respondent with a total of 22 people (26.5%). Ageing has a significant impact on the decline in glomerular filtration rate (GFR). Research shows that GFR in healthy adults at the age of 20 years ranges from 100-110 ml/min/1.73m², but can decrease by 5-25% when reaching the age of 50 years[16].

The most respondents in this study were those who had been on haemodialysis for less than 12 months with 34 people (41%). The duration of haemodialysis can affect nutritional status through the catabolism that occurs during the procedure. This catabolism leads to the loss of essential nutrients such as amino acids, vitamins, protein, and glucose. The longer the patient is on haemodialysis, the longer the catabolism process takes place. If not balanced with adequate nutritional therapy, the risk of malnutrition will increase[17]. From a total of 86 respondents, 66 people (76.7%) did not experience sarcopenia, while 20 people (23.3%) were detected to have sarcopenia. As we become older, our skeletal muscles naturally lose bulk and strength, a disease known as sarcopenia. This may lead to a decrease in our ability to do physical activities[5]. The three primary criteria that were defined by (EWGSOP) also (AWGS) for the diagnosis of sarcopenia[18].

Relationship between Haemoglobin and the Incidence of Sarcopenia: According findings of analysis at table 1, as we can see the Mann Whitney test of haemoglobin with the incidence of sarcopenia obtained a result of p=0.024 (p<0.05). Those findings assume indicate that there is a correlation between sarcopenia in haemodialysis patients in terms of haemoglobin levels. As line with study from of Tseng et al (2021) which tells low haemoglobin levels are significantly associated with a decrease in walking speed (p=0.01), weak hand grip strength (p=0.025), and the occurrence of sarcopenia (p=0.028) in patients undergoing haemodialysis[11]. A study in the Netherlands also suggested that lower haemoglobin levels correlated decreased muscle mass and strength (p<0.001) in kidney transplant patients who had previously undergone dialysis. These results were consistent after researchers measured muscle mass also muscle strength using two different methods, namely through creatinine and BIA levels as well as hand grip strength also (FTSTS) test[19].

Haemoglobin has a major role in binding also transporting oxygen to various tissues of human bodies. When haemoglobin levels decrease, the supply of oxygen to cells or tissues decreases leading to hypoxia in skeletal muscles thus affecting muscle strength also function. Low haemoglobin levels also reflect inadequate nutritional intake, inhibit protein synthesis, and result in decreased muscle mass, muscle strength, also may accelerate development sarcopenia. Low haemoglobin is often associated with anaemia, where anaemic patients tend to experience fatigue that lessens the need for physical exercise also motor control. Anaemic individuals' mitochondrial metabolism as well as myoglobin production are both impacted by iron shortage, which in turn hinders muscular function[20]. Anaemia is often experienced by patients undergoing haemodialysis and can exacerbate symptoms correlated decreased kidney function, such as fatigue, dyspnoea, oxidative stress, as well as decreased tolerance to physical activity. These conditions can negatively affect development strength also muscle hypertrophy[21].

Relationship between Creatinine and the Incidence of Sarcopenia: According on the results of the analysis in table 1 above, it can be seen that the Mann Whitney test of creatinine with the incidence of sarcopenia obtained the result of p=0.043 (p<0.05). those findings assume that there is correlation between sarcopenia in haemodialysis patients in terms of creatinine levels. This is in line with study of Kakita et al (2022) who said that has a strong correlation among creatinine levels also its derivatives with sarcopenia (p<0.001) in patients undergoing haemodialysis. These results remained consistent even after adjustments were made for factors such as demographics, physical condition, primary kidney disease, comorbidities, nutritional status, remaining kidney function, and treatment centre[13]. A Brazilian study suggested that increasing creatinine levels could reduce the prevalence of sarcopenia ratio by 21.2%[22]. Another study in Eastern Taiwan also stated that creatinine levels correlate with walking speed (p=0.003), and can be used as a marker to detect sarcopenia and assist in the screening process of sarcopenia in advanced CKD patients[23].

Creatinine is a substance produced from the metabolism creatine phosphate at skeletal muscle and total creatinine the body produces depends on skeletal muscle mass when kidney function is stable. Creatinine is easily filtered by the kidneys and not much reabsorbed so it can be a marker to estimate skeletal muscle mass in different groups of people[23]. Kidneys account for among 20% of production guanidinoacetic acid which is the direct precursor for creatine formation at human body. When kidney function gradually declines and animal protein intake is also low in haemodialysis patients with CKD, the creatine balance in the body may be disturbed. This may increase the risk of sarcopenia, fatigue, decreased cognitive ability, worsened life qualities, also improving mortality at patients CKD[22].

CONCLUSION

There is a big corelation among haemoglobin and creatinine levels also incidence sarcopenia in haemodialysis patients. Low haemoglobin (p=0.024) also creatinine (p=0.043) contributed to the increased risk of sarcopenia. Those results emphasise urgency monitoring both parameters to prevent and optimally treat sarcopenia.

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Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Natalia Hariyanti Ahmad Syauqy
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Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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