Malnutrition–Inflammation Score (MIS) and Physical Activity among Hemodialysis Patients

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Abstract

Background: Protein Energy Malnutrition (PEM) related to inflammation and physical activities reduction occur commonly among hemodialysis patients. This study aimed to describe Malnutrition-Inflammation Score (MIS) and physical activity of hemodialysis patients.
Methods: This study involved 117 patients in the Hemodialysis Unit of Dr. Hasan Sadikin General Hospital Bandung from September to October 2014. Secondary data were collected to examine MIS and physical activity, which was measured by using Baecke Physical Activity Questionnaire. The collected data were presented using frequency distribution.
Results: Eighty (68.4%) patients had MIS <6, thirty seven (31.6%) patients had MIS ≥6, and ninety four (80.3%) patients had light physical activity.
Conclusions: Most of the patients have MIS <6 and are physically inactive. [AMJ.2015;2(4):601–7]

Keywords: Hemodialysis, Malnutrition-Inflammation Score, physical activity

Introduction

The numbers of chronic kidney disease patients are rising rapidly in Indonesia. The incidence of end-stage renal disease patients who experienced hemodialysis has increased, from 2.077 patients (in 2002) to 4.344 patients (in 2006).[1] Among hemodialysis (HD) patients, Protein Energy Malnutrition (PEM) is a common problem, which can be a strong predictor for morbidity and mortality.[2] Nutritional management is a required therapy and a periodic nutritional status assessment is crucial in identifying nutritional problems as early as possible.[3] Several studies have shown a strong correlation between PEM and inflammation.[4] Malnutrition Inflammation Score is thus used as a simple, effective, and comprehensive method to measure malnutrition and inflammation in HD patients.[2,3]

Additionally, hemodialysis patients usually experience a decrease in physical activity as a result of several factors, such as excessive utilization of muscle mass as energy source leading to sarcopenia and presence of comorbidity e.g. diabetes, anemia, bone or mineral disorder.[5] The state of malnutrition and inflammation can assert influence on patients' physical activity.[6] Physical activity assessment proves useful for identification of problem and intervention to improve the quality of life.[7] There has not been any study about physical activity of HD patients in Indonesia hence, this study aimed to examine MIS and physical activity of HD patients.

Methods

A descriptive study was carried out to HD patients in the Hemodialysis Unit of Dr. Hasan Sadikin General Hospital during September and October 2014. This study has been approved by the Health Research Ethics Committee. Sampling was carried out by non-probability consecutive sampling. The minimum sample size was 96 and calculated using the formula for descriptive categorical variable with 10%

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Table 1 General Characteristics of Respondents

Features	n (%)
Sex	
Male	55 (47)
Female	62 (53)
Age (Years)	
≤40	19 (16.2)
41–60	67 (57.3)
>60	31 (26.5)
Causes of HD	
Diabetes Mellitus	29 (24.8)
Hypertension	56 (47.9)
Glomerulopathy	11 (9.4)
Obstructive Nephropathy	5 (4.3)
Nephritis caused by hyperuricemia	1 (0.9)
Chronic Pyelonephritis	12 (10.3)
Unknown	3 (2.6)

precision (d).

Out of 137 HD patients, 117 fulfilled the inclusion criteria. The inclusion criteria were age ≥ 18 years, having experienced hemodialysis for at least 3 months, and having MIS and physical activity records for the last 3 months. Patients who did not fulfill the inclusion criteria were excluded. Data on MIS and physical activity were collected secondarily from a previous study entitled *"Hubungan Polimorfisme PPARG, Kadar Leptin, TNF Alfa, dengan Massa Lemak pada Penderita Hemodialisis Kronik".*

Furthermore, data of MIS comprised four parts: food intake history, physical examination, body-mass index (BMI), and laboratory examination results. The enquiries to the patients included weight loss in the last 3-6 months and GI symptoms such as loss of appetites, nausea, vomiting, anorexia, diarrhea, dialysis history, subcutaneous fat depletion (in mid-upper arm and lateral trunk area), or muscle wasting (in shoulder and quadriceps muscles). The body mass index was divided into four categories respectively: ≥20, 18–19.9, 16–17.9, and <16 Kg/m2, serum albumin was also divided into four categories: ≥4, 3.5–3.9, 3–3.4, and <3. Meanwhile TIBC was also divided into 4 categories: ≥250, 200–249, 150–199, and <150 g/dl.3 Final MIS were categorized into 2 groups: <6 and ≥6.[3]

Data on physical activity was collected

Table 2 Malnutrition – Inflammation Score in HD Patients

Features	MIS <6	MIS ≥6
	n	n
Sex		
Male	40	15
Female	40	22
Age (Years)		
≤40	17	2
40–60	47	20
>60	16	15

Table 3 Distribution of MIS Components in HD Patients

Features	n	%
Change in End Dialysis Dry Weight (overall change in past 3-6 months)		
<0.5 kg	68	58.1
0,5–1 kg	29	24.8
≥ 1 kg but < 5 %	15	12.8
≥5%	5	4.3
Dietary Intake		
Good appetite and no deterioration of dietary pattern	94	80.3
Somewhat suboptimal solid dietary intake	19	16.2
Moderate overall decrease to full liquid diet	4	3.4
Hypo-caloric liquid to starvation	0	0
Gastrointestinal Symptoms		
No symptoms with good appetite	84	71.8
Mild symptoms, poor appetite or nauseated occasionally	32	27.4
Occasional vomiting or moderate GI symptoms	1	0.9
Frequent diarrhea or vomiting or severe anorexia	0	0
Functional Capacity (nutritionally related functional Impairment)		
Normal to improved functional capacity, feeling fine	85	72.6
Occasional difficulty with baseline ambulation, or feeling tired frequently	25	21.4
Difficulty with otherwise independent activities (eg. Going to bathroom)	5	4.3
Bed/chair-ridden, or little to no physical activity	2	1.7
Co-morbidity (including number of years on Dialysis)		
On dialysis < 1 yr and healthy otherwise	76	65
Dialyzed for 1-4 yr, or mild co-morbidity (excluding MCC*)	39	33.3
Dialyzed > 4 yr, or moderate co-morbidity (including I MCC*)	2	1.7
Any severe, multiple co-morbidity (> 2 MCC*)	0	0
Decreased fat stores or loss of subcutaneous fat		
Normal (no change)	53	45.3
Mild	55	47
Moderate	8	6.8
Severe	1	0.9
Signs of muscle wasting		
Normal (no change)	53	45.3
Mild	56	47.9
Moderate	7	6
Severe	1	0.9
Body mass index : BMI = Wt (kg)/Ht 2 (m)		
≥20	65	55.6
18–19.9	26	22.2

16–17.99	17	14.5
<16	9	7.7
Serum Albumin (g/dl)		
≥ 4	73	62.4
3.5–3.9	31	26.5
3-3–4	9	7.7
<3	4	3.4
Serum TIBC (mg/dl) :		
≥250	63	53.8
200–249	41	35
150–199	9	7.7
<150	4	3.4

*MCC (Major Comorbid Condition) Includes CHF class III or IV, full blown AIDS, severe CAD, moderate to severe COPD, major neurological sequlae, and metastatic malignancies or s/p recent chemotherapy

one time using Baecke Physical Activity Questionnaire (BQ).[8] It was consequentially divided into 3 categories: light, moderate, and heavy.

Results

Most HD patients (83.8%) were above 40 years old, the rest were under 40. Hypertension was the main cause (47.9%) of hemodialysis therapy, while diabetes mellitus was in the second place (24.8%).

According to the study by Kalantar-Zadeh[9], MIS is categorized into <6 and ≥6. There were 80 patients whose MIS was <6 and 37 patients whose MIS was ≥6. More patients whose MIS was ≥6 were from the age group between 40–60 years (54%) and >60 years (40.5%).

Most patients still experienced dry weight loss <0.5 kg at the end of dialysis in the last 3-6 months. Additionally, almost every patient (80.3%) still had good appetite and did not experience decrease in food intake. Only a small number of patients experienced decrease in food intake (19.6%).

Furthermore, almost a third of the patients had gastrointestinal symptoms and patients generally experienced mild loss of appetite or nausea (27.4%). Meanwhile, in the functional capacity aspects, 21.4% of patients sometimes had difficulty in performing basic activity or felt tired, 4.3% had difficulty with independent activities, and there was 1.7% who even were unable to do minimum activities (bed/chair-ridden).

More than 50% of patients experienced a decrease in fat storage and displayed muscle wasting. Most patients still had BMI ≥20 (55%), but there were 14.5% of patients whose BMI was <18 and 7.7% of patients whose BMI was <16. Furthermore, based on laboratory parameters, the majority of patients (62.4%)

Table 4 Physical Activity in HD Patients

Features	Physical Activity	
	Low	Moderate
Sex		
Male	41	14
Female	53	9
Age (Years)		
≤40	17	2
40–60	54	13
>60	23	8

Table 5 MIS and Physical Activity

Features	Physical Activity	
	Low	Moderate
MIS		
<6	63	17
≥6	31	6
MIS		
0–6	68	19
7–12	21	4
13–18	3	0
19–24	2	0
25–30	0	0

*MIS = Malnutrition-Inflammation Score

had good albumin levels, but there were still patients (3.4%) with very low albumin levels i.e. less than 3g/dl. Almost 50% of patients also had decreased serum TIBC levels, 3.4% even had serum TIBC levels that were lower than 150 mg/dl.

The majority of HD patients had low levels of physical activity. Out of the 117 sampled patients, 94% (80.3%) had low levels of physical activity and 23 (19.7%) had moderate levels of physical activity. No patients had high levels of physical activity. Moderate physical activity was mostly found in patients older than 40 years old.

The patients with MIS ≥6 mostly had low levels of physical activity (83.8%). While from the MIS categorization, it was discovered that higher levels of physical activity were mostly performed by patients with MIS <13. The levels of physical activity in patients with higher MIS were generally low.

Discussion

In general, HD patients in Dr. Hasan Sadikin General Hospital Bandung had good MIS i.e. less than 6; this cut-off point was based on the study conducted by Kalantar-Zadeh et al.[9] In other words, more patients had good nutritional status with low inflammation. Based on this cut-off point, MIS <6 can be categorized as "without malnutrition" and the higher MIS as "with malnutrition".[3] This study, using the patient's MIS discovered that 68.4% of patients were without malnutrition and 31.4% were with malnutrition. A study by Ebrahimzadehkor[3] which involved 48 patients in Iran, showed that 25% of patients had good nutritional status, while the rest suffered from malnutrition.

Moreover, high MIS (≥6) was mostly found among patients who were in >40 years old age group. Ebrahimzadehkor[3] presented a relation between age and low score of MIS in his study.

In this study, some patients experienced a decrease in food intake and suffered from gastrointestinal symptoms such as poor appetite and nausea. Causes of inadequate nutritional intake in patients with uremia are taste abnormalities (acuity, metal flavor, and dry mouth), gastropathy and enteropathy, accumulation of anorectic factors, inflammation and/or infection.[2] In addition, a third of the patients also had mild comorbidities that could affect nutritional and inflammatory conditions.

Malnutrition in HD patients could be observed from the physical changes such as fat storage decrease and muscle wasting. This is appropriate with the study involving 809 HD patients by Rambod et al.[10] and based on BMI scores, BMI <18.5 is the indicator of malnutrition.[2] In this study, 22.2% of patients had BMI <18. Serum albumin levels can also be used to detect malnutrition in HD patients. Serum albumin <3.5 g/dl indicates malnutrition. Furthermore, with every 1 g/dl decrease in albumin level, there is a 10% increase in mortality risk.[2] In this study, 11.1% of patients had serum albumin levels that were lower than 3.5 g/dl, and some patients almost suffered a decrease in serum TIBC levels.

As an inflammatory marker, MIS is similarly with IL-6, and is slightly better than CRP.[10] Every 2 points increase in MIS is associated with a double mortality risk. Early detection

in patients with risks of malnutrition and inflammation can give a better identification so that patients can get nutritional and anti-inflammatory interventions.[10]

In this study, 80.3% patients had low levels of physical activity. This finding agrees with a study by Wong, et al.[11] which discovered that more than 80% of patients has low levels of physical activity. Patients with HD needed two 4-hour hemodialysis sessions in a week and therefore had a tendency to be more passive compared to the healthy population. Procedures of HD itself can cause exhaustion and reduce physical activity level, and the presence of uremia can also decrease skeletal muscles' functions.[11] These could be observed in a third of the patients who suffered functional capacity disruption which resulted in fatigue and inability to do independent activities.

Additionally, patients older than 40 years mostly had low levels of physical activity, whereas other factors, such as mental and social changes, aging, unemployment, and decreased quality of life, can also contribute to the decrease of physical activity level among HD patients.[5]

In the group of patients with MIS ≥6, there were more patients with low levels of physical activity. Moderate levels of physical activity were mostly found in patients with MIS <12, while patients with higher MIS had low levels of physical activity. The group of patients with MIS <6 was the group with the highest level of physical activity. Besides, malnutrition and inflammation in HD patients cause increased proteolysis which leads to muscle wasting, included skeletal muscle, so HD patients have lower activity than passive non dialysis person.[7] A decrease in physical activity in HD patients can happen because patients choose to reduce their activity due to the presence of muscular atrophy and physical changes triggered by malnutrition and inflammation.[5]

Moreover, muscular atrophy could be observed in patients with MIS >6, which means that these patients suffered from more severe malnutrition and inflammation. Anand et al.[6] noted that patients with malnutrition and inflammation have low levels of physical activity. The number of studies on the correlation between physical activity, malnutrition, and inflammation were still low.[11]

The low physical activity levels in HD patients lead to muscular atrophy and contribute to decrease physical functioning. Low physical functioning has close correlation to low quality of life, increased hospitalization risk, and increased mortality rate.[5] Several studies showed intervention in physical activity to have benefits on metabolism and hemodynamic, quality of life, and functional capacity repair; hence an accurate strategy is needed to increase physical activity level in HD patients.[7]

The conclusion of this study is that most HD patients have MIS that is lower than 6, hence more patients have poor nutritional and inflammatory status. Besides, almost all patients have low level of physical activity.

This study is not without flaws. The minimum sampling criterion with 10% precision was still not maximum in data collection, though it can still be tolerated in a medical research. The secondary data collection involving MIS and physical activity measurement could also be a source of errors in this study.

There has not been any previous study about physical activity and MIS. Hence, this study could encourage other researchers and medical workers to conduct further studies on the correlation between physical activity and MIS.

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