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Malnutrition-Inflammation Score and Quality of Life in Hemodialysis Patients: Is There Any Correlation?

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Background: Malnutrition, inflammation and poor quality of life are prevalent among hemodialysis (HD) patients. Health-related quality of life is an important determinant of hospitalization and mortality in HD patients.

Objectives: The aim of this study was to assess the correlation between quality of life and malnutrition-inflammation status according to subjective global assessment (SGA) and malnutrition-inflammation scores (MIS) in HD patients.

Patients and Methods: We randomly selected 87 of 180 stable HD patients from two HD centers. Those on hemodialysis for at least three months and with malnutrition according to the SGA scores were included in this study. They were divided into two groups of mild to moderate malnutrition (n = 39) and severe malnutrition (n = 49) based on the SGA scores. Serum levels of transferrin, albumin, blood urea nitrogen, creatinine, kt/v, body mass index and malnutrition-inflammation scores were measured in all patients. Health-related quality of life was assessed by validated short form-12 (SF-12) questionnaire for each patient. These values were compared between the two groups of patients by independent sample t-test and Mann-Whitney U test. The correlations of nutritional variables with SGA and MIS scores were determined by Pearson and Spearman correlation tests.

Results: There were no differences in measured parameters between the two groups except for MIS scores. Those with severe malnutrition showed higher MIS scores. All quality of life aspects and total scores (PCS, MCS) (rather than social functioning (SF) aspect) were significantly different between the two groups, which showed lower physical and mental scores in severely-malnourished patients. Physical functioning (PF), role limitations due to physical heath (RP), general health (GH), mental health (MH), SF, role limitation due to emotional health (RE), vitality (VT) aspects and total scores (PCS and MCS) had negative significant correlations with MIS and SGA scores (All P values < 0.05). No correlation was found between MIS and SGA scores and other measured variables.

Conclusions: This study focused on important effects of malnutrition and inflammation on health-related quality of life aspects, both physically and mentally in HD patients. SGA and MIS are highly correlated with quality of life in HD patients.

Keywords: Malnutrition; Inflammation; Quality of Life; Uremia; Chronic Kidney Disease

1. Background

Chronic kidney disease with slow progression can cause irreversible loss of endocrine functions. Nutrition is a key factor in the assessment and treatment of kidney disease condition. Malnutrition caused by uremia in HD patients predisposes them to inflammatory status (1). Malnutrition, inflammation and depression are common findings in HD patients (2). Malnutrition-inflammation complex syndrome (MICS) is the major cause of cardiovascular disease, hospitalization and mortality in this group (3). According to the International Society of Renal Nutrition and Metabolism (ISRNM) Expert Panel, MIS and SGA scores are used in the set of criteria for protein-energy wasting (PEW) detection in HD patients (4). MIS is regarded as one of the nutritional scoring systems specific to patients with chronic kidney disease (5). MIS is highly correlated with hospitalization, coronary artery disease, mortality and depressive disorders in HD patients (5-9). On the other hand, impaired quality of life has been reported in HD patients and correlated with a poor outcome (10). In spite of advances in end stage renal disease (ESRD) treatments such as dialysis, a high rate of mortality is still demonstrated in HD patients (10). A poor quality of life in HD patients might deteriorate disease condition and patients outcomes. Quality of life is a strong predictor of mortality and hospitalization in HD patients (11).

2. Objectives

As there is no evidence of the relationship between MIS

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and SGA scores with health-related quality of life according to SF-12 questionnaire, this study aimed to assess the correlation between quality of life and malnutrition-inflammation status according to MIS and SGA scores in hemodialysis patients. Better identification and management of detrimental factors in quality of life in HD patients can be valuable in defining practical interventions toward improving quality of life and patients' outcomes.

3. Patients and Methods

A hundred and eighty patients on regular hemodialysis in Namazi and Shahid Faghihi dialysis centers affiliated to Shiraz University of Medical Sciences entered this study. Those on stable HD for at least three months without any acute illness, infection or hospitalization were regarded eligible for enrollment. Those with different stages of malnutrition according to the SGA scores were included in the study. Patients receiving multivitamins, protein, amino acid or any nutritional supplements except for folic acid within three months prior to the enrollment were excluded. Eligible participants gave their informed consent to participate in this study. The study was performed in accordance with the Declaration of Helsinki and Good Clinical Practice Guidelines. Additionally, the study protocol was approved by the Ethics Committee of Shiraz University of Medical Sciences. All HD patients were on hemodialysis 2 - 3 times a week for at least three months. These participants were dialyzed by low-flux dialyzer with polysulfone/ polyamide membranes, reverse osmosis, purified water and bicarbonate-containing dialysis solution. Blood samples were taken before the beginning of HD session from the patients' arm used for HD cannula. The serum was separated by centrifugation at 3000 g/min for 5 minutes and stored at -70°C until the biochemical analysis. Serum levels of albumin, transferrin, blood urea nitrogen and creatinine were measured in all patients. Standard automated techniques were used for measuring study parameters. SGA and MIS scores were used to assess patients' nutritional status. SGA questionnaire evaluated nutritional status of patients (any changes in the preceding 2 weeks and 6 months, dietary intake, appetite and gastrointestinal symptoms). Additionally, functional capacity of patients was assessed by SGA questionnaire (12). All questions were read to patients by an expert dietitian who works regularly with HD patients. All physical examinations related to SGA questionnaire (loss of subcutaneous fat, muscle wasting and presence of ankle or sacral edema) were performed by the same person. After assigning 5 points for each item, the results were interpreted as follows: a score of less than 10 as well-nourished, 10 - 17 as mild to moderate malnutrition (at risk of malnutrition) and more than 17 as severe malnutrition (12). According to the final SGA scores, malnourished patients were classified into two different groups with various malnutrition severities. On the other hand, MIS questionnaire which is a more quantitative one has four sections including nutritional history, physical examination, body mass index and laboratory values. This questionnaire includes 10 components and is more complete than SGA questionnaire. The first three sections are similar to SGA items, but the fourth section comprises two laboratory markers of serum albumin and transferrin. Each component gets a score between 0 (normal) to 3 (severely malnourished) in which a higher score means a more severe degree of malnutrition and inflammation (5). Due to the assessment of visceral proteins by the MIS questionnaire, this can be a better indicator of MICS (11, 13). The validated Iranian version of SF-12 questionnaire (14) was implemented to assess health-related quality of life in HD patients. SF-12 questionnaire is the short form of SF-36 questionnaire to assess health-related quality of life in HD patients. This questionnaire is shorter and includes only one third of the SF-36 questionnaire. SF-12 questionnaire comprises 12 items (questions) and 8 scales including physical functioning (PF), role limitations due to physical health (RP), general health (GH), bodily pain (BP), social functioning (SF), vitality (VT), mental health (MH) and role limitation due to emotional health (RE). These scales are computed into two summary components of PCS-12 and MCS-12 (15). All SF-12 questions were read to patients by the main investigator. Data was analyzed using SPSS software (Statistical package for the Social Sciences, version 15, SPSS Inc., Chicago, USA). Kolmogorov-Smirnov test was used to assess the normality of distribution. The results were presented as means ± standard deviations for parametric and medians (interquartile ranges) for skewed data. To compare variables between different severities of malnutrition (mild to moderate or severe malnutrition) according to SGA classification, independent sample t-test and Man-Whitney U test were used for parametric and nonparametric data, respectively. The correlations were calculated by Spearman and Pearson correlation tests. P value less than 0.05 was considered significant.

4. Results

A total of 87 patients were enrolled in the current study. Patients were divided into two groups of mild-to-moderate malnutrition (n = 38, SGA: 10 - 17) and severe malnutrition (n = 49, SGA > 17). There were no differences in measured parameters between the two groups except for MIS scores that showed higher MIS scores in patients with severe malnutrition. Lower body mass index in the severely malnourished patients was demonstrated compared to those with mild to moderate malnutrition, but this difference was not statistically significant between the groups (Table 1). Regarding the quality of life aspects, all mental and physical aspects (rather than SF) and the total scores of mental and physical aspects (PCS, MCS) were significantly different between the two groups, which showed lower physical and mental scores in severely-malnourished patients (Table 2). The correlations between SGA and MIS scores and measured variables including serum albumin, transferrin, body mass index and physical and

Table 1. Clinical and Nutritional Parameters in Hemodialysis Patients by Nutritional Status According to Subjective Global Assessment Scores[a]

Parameters	Mild to Moderate Malnutrition (n = 38)	Severe Malnutrition (n = 49)	P Value[b]
Age, y	56.4 ± 9.6	53.9 ± 11.3	0.27
Duration of dialysis, mo	17.7 ± 8.3	15.02 ± 4.9	0.1
Dialysis adequacy Kt/v	1.24 ± 0.28	1.35 ± 0.24	0.055
Serum albumin, g/dL	3.3 ± 0.43	3.3 ± 0.48	0.81
Serum transferrin, g/dL	194.47 ± 10.61	191.6 ± 14.2	0.36
Blood urea nitrogen, mg/dL	122.2 ± 27	114.3 ± 37.3	0.27
Serum creatinine, mg/dL	8.6 ± 2.1	7.6 ± 2.8	0.086
Malnutrition-inflammation score	9.6 ± 2.2	14.7 ± 3.48	< 0.001
Body mass index, kg/m2	23.17 ± 3	22.97 ± 4.2	0.82

[a] Data are expressed as Mean ± standard deviation for normal data.
[b] Comparisons were performed using independent sample t-test for parametric data.

Table 2. Quality of Life Aspects in Hemodialysis Patients by Nutritional Status According to Subjective Global Assessment Scores[a]

Aspects	Mild to Moderate Malnutrition (n = 38)	Severe Malnutrition (n = 49)	P Value[b]
Physical functioning (PF)	50 (50, 50)	0 (0, 0)	< 0.001
Role limitation due to physical health (RP)	50 (50, 50)	25 (0, 50)	< 0.001
General health (GH)	50 (25, 50)	25 (0, 50)	< 0.001
Bodily pain (BP)	75 (50, 75)	50 (25, 75)	0.006
Social functioning (SF)	50 (50, 50)	50 (25, 50)	0.15
Role limitation due to emotional health (RE)	50 (50, 75)	50 (25, 75)	0.013
Mental health (MH)	50 (50, 75)	50 (25, 75)	0.019
Vitality (VT)	50 (50, 75)	50 (25, 50)	< 0.001
Physical component summary (PCS)	53.6 ± 13.3	33.16 ± 20.16	< 0.001
Mental component summary (MCS)	56.25 (50, 68.75)	50 (25, 56.25)	0.003

[a] Data with normal distribution are expressed as mean ± standard deviation and skewed data as median (interquartile range).
[b] Comparisons were performed using independent sample t-test and Mann-Whitney U test for parametric and nonparametric data, respectively.

mental aspects of quality of life are shown in Table 3. No correlation was found between MIS and SGA scores and measured variables except for some of the quality of life aspects. PF, RP, GH, MH, SF, RE, and VT aspects and total scores (PCS and MCS) showed significant negative correlations with MIS (r = -0.349, -0.402, -0.312, -0.359, -0.237, -0.373, -0.357, -0.384, -0.313, respectively) and SGA scores (r = -0.385, -0.446, -0.344, -0.26, -0.247, -0.269, -0.379, -0.334, -0.334, respectively). P values and the correlation coefficients of all correlations are presented in Table 3.

5. Discussion

This study was the first to assess the correlations between health-related quality of life measures and malnutrition-inflammation status in HD patients according to SF-12 questionnaire. On the other hand, study variables were compared between different severities of malnutrition in study patients. All measured variables including serum albumin, transferrin, creatinine, blood urea nitrogen, kt/v, body mass index and duration of dialysis were not significantly different between the two groups of severe malnutrition and mild to moderate malnutrition. Patients with severe malnutrition showed higher MIS scores or "a poor malnutrition-inflammation status". On the other hand, lower body mass indexes were seen in severely malnourished patients, but this difference was not statistically significant and might be due to low sample size in our study. While in a study by Ekramzade and colleagues, HD patients with malnutrition showed a lower body mass index compared to well-nourished patients (16). Malnutrition and inflammation are leading causes of MICS in HD patients (17). Overlapping of these two conditions causes a complex clinical status based on a vicious cycle in which inflammation and malnutrition

Table 3. Correlations Between Subjective Global Assessment and Malnutrition Inflammation Scores and Quality of Life Aspects and Study Variables in Patients on Hemodialysis

Variables	Subjective Global Assessment Score		Malnutrition-Inflammation Score	
Parameters	**Correlation Coefficient**	**P Value**	**Correlation Coefficient**	**P Value**
Quality of life aspects				
Physical functioning	-0.385	< 0.001	-0.349	0.001
Role limitation due to physical health	-0.446	< 0.001	-0.402	< 0.001
General health	-0.344	0.001	-0.312	0.189
Bodily pain	-0.209	0.052	-0.119	0.27
Social functioning	-0.247	0.021	-0.237	0.027
Role limitation due to emotional health	-0.269	0.012	-0.373	< 0.001
Mental health	-0.26	0.015	-0.359	0.001
Vitality	-0.397	< 0.001	-0.357	0.001
Physical component summary (PCS)	-0.384	< 0.001	-0.334	0.001
Mental component summary (MCS)	-0.313	0.003	-0.37	< 0.001
Other parameters				
Body mass index, kg/m^2	-0.001	0.99	-0.124	0.25
Serum transferrin, g/dL	-0.036	0.74	-0.027	0.8
Serum albumin, g/dL	-0.037	0.73	-0.033	0.76

deteriorates each other in a mutual manner. Malnutrition might emanate from inflammatory status (3). Negative nitrogen balance, weight loss and anorexia are more prevalent in HD patients due to inflammation (3). Malnutrition by itself might cause inflammatory status in ESRD patients (16). MIS and SGA scores as surrogate markers of inflammation and malnutrition are associated with prospective mortality in HD patients (5, 11, 18, 19). In the current study, after comparing different aspects of quality of life according to SF-12 questionnaire in the two groups, all aspects were significantly different that showed a lower quality of life (both mentally and physically) in patients with severe malnutrition compared with those with mild to moderate malnutrition. Additionally, significant negative correlations were found between all quality of life aspects (except for BP) and SGA and MIS scores. In a study by Rambod and colleagues, negative correlations were found between MIS and quality of life measures according to SF-36 questionnaire (11). Moreover, in a study by Santos and colleagues, a higher food intake and a better nutritional status was positively associated with health-related quality of life in HD patients (1). In addition, Bilgic and colleagues found a significant association between MIS and poor quality of life (based on SF-36 questionnaire) and poor sleep disorders in HD patients (8), which all are in consistent with the results of the current study. In a meta-analysis by Brennan and colleagues, nutritional biomarkers (body mass index, serum albumin and creatinine) were correlated with quality of life according to SF-36 questionnaire (20), while MIS and SGA scores were not assessed in their study. Quality of life is a predictor of survival in HD patients (21, 22). Hence, correlation between quality of life and MIS or SGA score focuses on the effects of malnutrition-inflammation status on HD patients' survival. Psychological and mental aspects of quality of life are important determinants of death and hospitalization in HD patients (23). In the current study, it would be better to compare measured variables in HD patients with a control group with normal kidney function to improve quality of our study and this is considered a limitation of our study. Further studies with larger sample sizes and healthy controls are needed to confirm these results. In conclusion, our results focused on important effects of malnutrition and inflammation on health-related quality of life aspects, both physically and mentally in HD patients. MIS and SGA as constellations of readily available clinical and paraclinical variables are correlated with quality of life aspects in hemodialysis patients. Further studies are needed to clarify the contributing factors to poor quality of life and its related outcomes in hemodialysis patients. More longitudinal studies are needed to assess the association of malnutrition and inflammation status with quality of life and related risk factors in these patients. Early identification and management of deteriorating factors in quality of life of HD patients can be valuable in defining practical interventions toward improving quality of life in these patients.

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