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ASSESSMENT OF NUTRITIONAL STATUS IN MAINTENANCE HEMODIALYSIS PATIENTS: A DESCRIPTIVE CROSS SECTIONAL STUDY

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ABSTRACT **Background:** To assess the nutritional status of maintenance haemodialysis (MHD) patients using Modified Quantitative Subjective Global Assessment Score (MQSGA) and to analyse the correlation of anthropometric measurements, lab parameters & clinical history with the nutritional status. **Study design:** We conducted a cross sectional descriptive study to assess the nutritional status of 72 patients undergoing MHD by using MQSGA. Further anthropometric measurements, lab tests and clinical history was analysed in all participants. **Results:** Based on MQSGA criteria, 76.3% of the patients had mild to moderate malnutrition, 23.7% patients had normal nutritional status and no patient had severe malnutrition. Age ($p=0.001<0.01$) and duration of dialysis ($p=0.002<0.01$) was significantly associated with nutrition status of the patients. Education level was associated with the nutritional status of the patients, those with college level education had higher MQSGA score ($p=0.001<0.01$). Most of the malnourished patients had diabetes ($p=0.013< 0.05$) and positive C-Reactive Protein [CRP] ($p=0.001< 0.05$). Nutritional status of the patients was not significantly associated with Coronary artery disease (CAD)/Dilated cardiomyopathy (DCM)/Left Ventricular Systolic Dysfunction (LVSD) ($p=0.361>0.05$) and type of vascular access ($p=0.186>0.05$). Haemoglobin ($p=0.001<0.01$), Serum Albumin ($p=0.001<0.01$), urea ($p=0.001<0.01$), creatinine ($p=0.001<0.01$), S. phosphate ($p=0.001<0.01$) and potassium ($p=0.009<0.01$) and anthropometric parameters like mid-arm-circumference ($p=0.001<0.01$), triceps skin fold thickness ($p=0.001<0.01$) and body mass index ($p=0.001<0.01$) were higher in well nourished patients. **Conclusion:** This study showed that anthropometric measurements, certain lab parameters & MQSGA score correlated well with the nutritional status. So these can be used as a screening tool in dialysis unit to diagnose malnutrition.

KEYWORDS : Malnutrition, MQSGA score, Nutritional status, maintainence hemodialysis.

INTRODUCTION

Chronic kidney disease (CKD) is a major public health problem worldwide because end stage renal disease (ESRD) patients should undergo lifelong hemodialysis if transplantation cannot be done [1]. Main factor that cause mortality in CKD is cardiovascular diseases. One of the common non cardiovascular complications in hemodialysis (HD) patients is Protein energy malnutrition (PEM). Presence of malnutrition is also associated with increased mortality & morbidity. The etiology of malnutrition in HD patients is multifactorial. They are poor food intake (which may be due to uremia induced anorexia), dysguesia, comorbid illness, stress, inability to cook food, tasteless food (due to salt restriction advised by physician), dialysis per se aggravates malnutrition by increasing protein catabolism and by removing nutrients, taking repeated blood samples for lab investigation, blood remaining in the dialyzer and tubing [2].

Assessment of nutritional status in HD patients at regular intervals is necessary for early diagnosis & intervention of malnutrition [3,4]. There are many scoring systems and tools for assessing the nutritional status. They are BMI, serum albumin, serum prealbumin, serum creatinine, creatinine index, serum transferrin, serum cholesterol, anthropometric measurements (like skin fold thickness, mid arm circumference [MAC], mid arm muscle circumference [MAMC], bio electric impedance, dual energy x-ray absorptiometry [DEXA], total body nitrogen & potassium estimation, near infrared reactance [5-7].

Each method has its own limitations. BMI does not differentiate muscle mass from fat mass and is influenced by hydration. Anthropometric measures have inter & intra observer variability, and is very difficult to apply in a busy hemodialysis unit [8]. Serum albumin & pre albumin is influenced by inflammation. Serum transferrin levels is affected by the chronic blood loss & by the administration of erythropoietin. Tests like DEXA & near infrared reactance are expensive and are not widely available. Since biochemical markers & anthropometric measurements have many limitations, a holistic tool incorporating multiple parameters and subjective assessment of patients wellness will be better in assessing nutritional status. Subjective global assessment (SGA) is one such scoring system that is recommended by the American society for parenteral & enteral nutrition (ASPEN) [9].

SGA scoring system was developed by detsky et al in 1984, since then it has undergone many modifications. Modified SGA is a quantitative scoring system which has 7 components. The total score ranges from 7 to 35. It is simple and can be performed within minutes by a paramedical staff [1].

In India, there is high prevalence of malnutrition in hemodialysis patients, but there are very few studies about nutritional status of Indian end stage renal disease (ESRD) patients. As India is a large country with diverse cuisines & food practices, a nutritional study in southern part of India will be different from that of the north Indian patients. Moreover, this study was done in a government tertiary care center, which caters to the health needs of people with low socioeconomic status. Our center provides HD, investigations & drugs to such patients at free of cost. As studies like this are lacking in this region, this study will help other hospitals & clinicians to improve the nutritional status of ESRD patients.

MATERIALS AND METHODS

This study was done to assess nutritional status of ESRD patients undergoing HD at government Rajaji hospital, Madurai. Seventy two patients were included in this study after getting written informed consent. Institutional ethics committee approval was obtained. Patients > 18 years with a minimum duration of dialysis more than 6 months without previous history of renal transplant were included in the study. Patients with malignancy, tuberculosis, other active infections, liver disease were excluded from the study (as these conditions can influence the nutritional status).

Patient's nutritional status was assessed using modified SGA score. MQSGA score has 7 components; They are weight change, dietary intake, gastrointestinal symptoms, comorbidity, functional capacity, signs of subcutaneous fat and muscle wasting. Based on the SGA score patient was classified into 3 categories normal nutrition (score of 7 to 10), mild to moderate malnutrition (score of 11-20), and severe malnutrition (score of 21 to 35). Laboratory blood investigations like haemoglobin, urea, creatinine, potassium, random blood sugar, serum albumin, CRP, serum bicarbonate, serum cholesterol was done. Some of the above test results were obtained from patient files. A detailed medical history was elicited with emphasis to presence of diabetes, dilated cardiomyopathy/ Left Ventricular systolic dysfunction, duration of dialysis, access for dialysis & education status. Anthropometric evaluation was done after completion of hemodialysis. Triceps skin fold thickness (TSF) was measured using a skin fold caliper & inch tape was used for measuring mid arm

circumference (MAC). Arm without AV (arteriovenous) fistula was chosen for these measurements. To avoid intra observer variability, these parameters were measured 3 times and average of these measurements was taken as final value. Mid arm muscle circumference (MAMC) was calculated by substituting TSF and MAC values in the formula, MAMC = MAC – (3.14 X TSF).

Statistical Analysis

Statistical analysis was carried out using R-Programming. The categorical variables were represented by frequency and percentage whereas the continuous variables were represented by mean and standard deviation. Chi-square test/Fisher's exact test was used to ascertain the association between two categorical variables whereas unpaired t test was used to find the association between one continuous variable and one categorical variable with two categories. Pearson correlation analysis was used to find the linear relationship between two continuous variables. Statistical significance was considered 5% level of significance (p<0.05).

RESULTS

Demographic and clinical history of maintenance hemodialysis patients (MHD) were analysed with the MQSGA score. Table 1 shows the Comparison of demographic and clinical history of the patients with nutritional status**.** In our study, there were 17 well-nourished MHD patients and 55 mild to moderate malnutrition patients according to the MQSGA score. Fisher's exact test reveals that there was no association between gender and nutrition status of the MHD patients (p=0.183>0.05). Age was significantly associated with nutrition status of the patients (p=0.001<0.01). Patients with mild to moderate malnutrition were more aged than well-nourished patients. Duration of dialysis was associated with nutrition status of the patients (p=0.002<0.01). I.e., Majority of the MHD patients (88.2%) who underwent dialysis for less than one year were well-nourished whereas the majority of the patients (54.5%) who underwent dialysis for more than one year had mild to moderate malnutrition patients. Education level was associated with the nutritional status of the patients, those with college level education had higher MQSGA score (p=0.001<0.01) and so were well nourished. Also CRP had significant association with malnutrition, most of the well nourished patients (82.4%) had negative CRP whereas most of the patients with mild to moderate malnutrition (72.7%) had positive CRP (p=0.001< 0.05). Majority of the diabetic patients undergoing maintainence hemodialysis in our study had mild to moderate malnutrition (p=0.013< 0.05). The statistical significance value (p>0.05) clearly revealed that nutritional status of the patients were not significantly associated with CAD/DCM/LVSD (p=0.361>0.05) and Type of vascular access (p=0.186>0.05).

Table 1: Comparison of demographic and clinical history of the patients with nutritional status

Variables	SGA Score		Statistic & p-value
	Normal	Mild to moderate	
Sex			
Male	11 (64.7%)	45 (81.8%)	FE test p = 0.183
Female	6 (35.3%)	10 (18.2%)	
Age (Mean±SD)	33.12±13.37	49.29±12.30	t = -4.643 p= 0.001**
Education			
Uneducated	3 (17.6%)	3 (5.5%)	FE test p=0.001**
Primary	2 (11.8%)	13 (23.6%)	
Secondary	5 (29.4%)	36 (65.5%)	
College level	7 (41.2%)	3 (5.5%)	
Diabetes Mellitus			
Absent	12 (70.6%)	20 (36.4%)	χ2 = 6.160 p=0.013*
Present	5 (29.4%)	35 (63.6%)	
CAD/DCM/LVSD			
Absent	14 (82.4%)	37 (67.3%)	FE test p=0.361
Present	3 (17.6%)	18 (32.7%)	
Duration of Dialysis			
< 1 Year	15 (88.2%)	25 (45.5%)	χ2 = 9.626 p=0.002**
>1 Year	2 (11.8%)	30 (54.5%)	
Type of Vascular Access			
AVF	14 (82.4%)	36 (65.5%)	χ2 = 1.748 p=0.186
IJV catheter	3 (17.6%)	19 (34.5%)	
CRP			
Negative	14 (82.4%)	15 (27.3%)	χ2 = 16.378 p=0.001**
Positive	3 (17.6%)	40 (72.7%)	

CAD coronary artery disease, DCM dilated cardiomyopathy, LVSD left ventricular systolic dysfunction, AVF arteriovenous fistula, IJV internal juglar vein, CRP C reactive protein

Anthropometry and lab parameters were compared among well-nourished MHD patients and mild to moderate nutrition MHD patients. Table 2 shows the Comparison of anthropometry and lab parameters between well-nourished MHD patients and mild to moderate nutrition MHD patients. The biochemical parameters such as haemoglobin (p=0.001<0.01), Serum Albumin (p=0.001<0.01), urea (p=0.001<0.01), creatinine (p=0.001<0.01), Serum Phosphate (p=0.001<0.01) and potassium (p=0.009<0.01) and the anthropometry parameters such as mid-arm-circumference (p=0.001<0.01), triceps skin fold thickness (p=0.001<0.01) and body mass index (p=0.001<0.01) were statistically different among well-nourished MHD patients and mild to moderate nutrition MHD patients. The mean scores revealed that well-nourished MHD patients had more haemoglobin, Serum Albumin, urea, creatinine, serum potassium, serum phosphorus, mid-arm-circumference, triceps skin fold thickness and body mass index compared to that of mild to moderate nutrition MHD patients. Table 3 shows the correlation between SGA score, anthropometry and biochemical parameters. SGA scores were negatively correlated with haemoglobin (r=-0.414), urea (r=-0.462), serum creatinine (r=-0.623), serum potassium (r=-0.167), Mid Arm Circumference (r=-0.733), Triceps Skin Fold Thickness (r=-0.736) and BMI (r=-0.348). However, there was no significant variations in the levels of RBS (p=0.338>0.05) and S.cholesterol (p=0.977>0.05) among the well nourished and malnourished patients.

Table 2: Comparison of anthropometry and lab parameters between well-nourished MHD patients and mild to moderate nutrition MHD patients

Variables	SGA Score		Statistic & p-value
	Normal	Mild to moderate	
	Mean ± SD		
Hemoglobin	9.08±1.14	7.35±1.41	t = 5.185 & p= 0.001##
Serum Albumin	3.92±0.39	3.18±0.57	t = 4.990 & p= 0.001##
Urea	151.65±35.09	107.20±29.95	t = 5.134 & p= 0.001##
Creatinine	10.48±1.51	6.31±1.84	t = 8.459 & p= 0.001##
Random blood sugar	131.82±43.38	148.20±65.49	t = -0.965 & p= 0.338
Serum phosphate	4.78±1.65	6.48±1.43	t = -4.137 & p= 0.001##
Potassium	5.09±0.50	4.55±0.76	t = 2.705 & p= 0.009##
Mid Arm Circumference	31.36±0.71	22.25±1.49	t = 24.213 & p= 0.001##
Triceps skin fold thickness	11.25±0.79	8.08±0.67	t = 16.294 & p= 0.001##
Serum Cholesterol	181.88±53.18	181.45±52.18	t = 0.029 & p= 0.977
Body mass index	24.55±4.76	20.45±3.33	t = 3.979 & p= 0.001##

##p<0.01

Table 3: Correlation between SGA score, anthropometry and biochemical parameters

Variables	Pearson Correlation	
	r-value	p-value
Age	0.139	0.244
Duration Of Dialysis#	0.315	0.007##
Hemoglobin	-0.414	0.001##
Serum. Albumin	-0.220	0.063
Urea	-0.462	0.001##
Creatinine	-0.623	0.001##
Random blood sugar	0.100	0.406
Serum phosphate	0.438	0.001##
Serum Potassium	-0.167	0.160
Mid Arm Circumference	-0.733	0.001##
Triceps Skin Fold Thickness	-0.736	0.001##
Body Mass Index	-0.348	0.003##
Serum Cholesterol	-0.008	0.949

#Point biserial correlation, **p<0.01

DISCUSSION

Many studies support the fact that malnutrition is highly prevalent in dialysis patients, ranging from 25 to 95% being malnourished [11-14]. Assessment of nutritional status in our hospital revealed malnutrition in 76% of the maintainence hemodialysis patients. Based on MQSGA criteria, 76.3% of the patients had mild to moderate malnutrition, 23.7% patients had normal nutritional status and no patient had severe malnutrition.

Ageing per se decreases body cell mass & elderly patients are more prone for malnutrition [15-18]. Similar finding was observed in our study, with malnutrition being more in elderly participants. This may be explained by difficulty in cooking, decreased appetite, associated chronic comorbidities in the elderly patients.

Previous studies showed that malnutrition was more common in females [19,20], but our study showed no association between gender and malnutrition.

Studies have shown that educated patients have a better nutritional status [21, 22]. Our study also showed that patients with college level education had a better MQSGA score.

Diabetic ESRD patients are more prone to develop malnutrition than non diabetics, this is due to the insulin deficiency and insulin resistance [23,24]. In our study there was significant correlation between presence of diabetes & nutritional status. Most of the diabetic patients undergoing maintainence hemodialysis were malnourished.

Cardiac failure patients are at more risk for malnutrition. Cardiac failure per se can cause increased weight loss, which is called as cardiac cachexia [25-28]. But our study did not show any correlation between presence of cardiomyopathy/ LV systolic dysfunction and malnutrition.

Low grade inflammation is common in CKD patients. Malnutrition also promotes inflammation. Malnutrition, inflammation & atherosclerosis often coexist, which is known as MIA syndrome [29, 30]. Kalantar zadeh et al study showed a significant correlation between CRP levels & MQSGA [31]. Our study also showed that majority of the malnourished patients had positive CRP.

Several studies demonstrate a negative relationship between serum albumin levels & mortality. Lower albumin levels in dialysis patients may be due to decreased protein intake & decreased albumin synthesis [32, 33]. In our study serum albumin levels were lower in patients with malnutrition. But albumin can also be low in patients with inflammation and fluid overload.

Many previous studies showed that MQSGA score is inversely related to anthropometric measures like TSF, BMI & MAC [34,35]. Results of our study also showed similar correlation between MQSGA score & anthropometric parameters. Thus anthropometric measurements is equally effective to MQSGA scoring in evaluating nutritional status of dialysis patients [1].

Multiple studies prove that a higher BMI is associated with improved survival [36, 37] and a lower BMI is suggestive of malnutrition [38]. Our study results confirmed this finding.

ESRD patients usually have dyslipidemia [39]. But a serum cholesterol of < 100mg/ dl is suggestive of protein energy wasting in dialysis patients [40]. Our study showed no statistically significant association between nutritional status and lipid levels. This may be due interplay of factors like poor dietary intake, pre existing dyslipidemia & diabetes in the participants [41,42].

Limitations

There are many limitations in this study. The small sample size may limit the power of the study. We recruited 70% of the maintainence hemodialysis patients form our hospital in the study, but there was no sample at the severely malnourished level. This may be due to the small sample size. Inflammatory markers (except CRP) to assess the degree of systemic inflammation was not analysed in this study. Also, we did not use more advanced methods like dual energy X-ray absorptiometry (DEXA) and bioelectrical impedance in this study. Prospective studies are better in assessing the causality. Since our study was a cross sectional study only associations could be studied.

CONCLUSION

Periodic monitoring & surveillance of nutritional status of hemodialysis patients should be done, this helps in implementing preventive strategies like dietary advice & protein supplements. A combination of anthropometric measurements & MQSGA scoring is a reliable tool for screening nutritional status. Proper evaluation & intervention of malnutrition may help in decreasing the morbidity & mortality of the patients.

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Compliance with ethical standards

Conflict of interest: The author(s) have declare that they have no conflict of interest.

Research involving human participants and/or animals Yes, this research involve human participants for which ethical approval was taken from institute's ethical committee (Reg No: ECR/1365/INST/TN2020).

Informed consent An informed consent was taken from all patients before doing anthropometric measurements & blood tests. Informed consent was also obtained regarding publishing their data.

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