Nutritional assessment of patients under hemodialysis in Nepal Medical College Teaching Hospital

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ABSTRACT

Malnutrition is very common in hemodialysis patients and is predisposed by many factors. Malnutrition is associated with increased morbidity and mortality. Total of 26 patients (16 males and 10 females) who were under hemodialysis in our center were included in the study. With the help of Malnutrition Score (MS) developed by Kalanter-Zadeh, nutritional status of the patients was assessed. Patients also underwent different anthropometric measurements such as Body Mass Index (BMI), Triceps skin fold thickness (TSF), Mid Arm Circumference (MAC) and Mid Arm Muscle Circumference (MAMC) and laboratory investigations. Mean age of the study population was 42.58±16.32 years (range 19 to 74 years). Females were older than males. MS of the study population was 15.82±3.76 (range 9-24). Female patients were having higher MS than males (16.5±4.11 vs. 15.06±3.55). Based on MS, 22 patients (84.6%) had mild to moderate malnutrition, 2 (7.7%) patients were having severe malnutrition and remaining 2 (7.7%) had normal nutrition score. Females were having lower BMI, MAC and MAMC but higher value of TSF. Significant negative correlation was present between MS and weight, BMI, MAC and MAMC. Calculated Urea Reduction Ratio (URR) of study population was 57.27±10.89. URR was higher in females than in males (61.77±12.74 vs. 54.45±8.85). Only 23.0% of the study population had URR of >65.0%. Protein Catabolic Rate (nPCR) in our study was 0.77±0.28g/kg/day. Malnutrition is very common in our center which is >90% when MS was considered. In our study it negatively correlated with weight, BMI, MAC and MAMC. Dialysis inadequacy was present in around 75.0% of our study population.

Keywords: Malnutrition, Malnutrition Score, Anthropometric measurements, Hemodialysis, Dialysis inadequacy.

INTRODUCTION

Malnutrition in End Stage Kidney Disease (ESKD) patients is very common affecting ~10.0-70.0% of hemodialysis (HD) patients.[1] Malnutrition in HD patients is strongly associated with increased mortality and morbidity.[2-5] There are many factors which predispose malnutrition in HD patients viz. poor intake, dietary restriction, infection, inflammation, co-morbidities, increased loss of nutrients and increased protein catabolism.[4-6] Malnutrition in dialysis patient is associated with poor survival. The survival rate of patients with renal failure has not changed in last 20 years despite intensive treatment. The main determinants of mortality and morbidity in HD are nutritional status of the patients and dialysis adequacy index.[1] Due to poor economic conditions of Nepali patients, we are not able to maintain dialysis adequacy as per the guideline. But nutritional status of the patients can be improved if we can create an awareness regarding it in the population. In Nepal, till date no study has been conducted to assess the nutritional status of HD patients. So we conducted this study in our center to assess the nutritional status of HD patients using conventional Subjective Global Assessment (SGA) Malnutrition score (MS) developed by Kalantar- Zadak *et al* for assessing nutritional status of our patients[7] and compared it with biochemical and anthropometric measurements.

MATERIALS AND METHODS

This was a cross sectional descriptive-analytic study carried out in HD unit of Nepal Medical College Teaching Hospital (NMCTH) in 2008. We included those patients who were on maintenance hemodialysis and were not having any active infection or underlying diseases and who could give consent. Malnutrition score (MS) forms were filled for each enrolled patient by a nephrologist and a physician separately within an interval of around 15 minutes. MS has seven components which are change in weight, dietary history, gastrointestinal symptoms, functional capacity, comorbidities, and assessment of subcutaneous fat and signs of muscle wasting (Table-1). Each component has a score between one (normal) to five (very severe). Thus MS has a total score between 7 and 35. Patients having

Table-1: Various components of malnutrition score

(A) Patients' Medical History:				
a) Weight (wt.) change (overall change in past 6 months)				
1 no wt. change or gain	2 minor wt. loss (<5.0%)	3 Wt. loss 5.0 to 10.0%	4 Wt. loss 10.0to 15.0%	5 Wt. loss >15.0% in past 6 months
b) Dietary intake				
1 no change	2 sub-optimal solid diet	3 full liquid diet or moderate overall decrease	4 hypo-caloric liquid	5 starvation
c) Gastrointestinal (GI) symptoms				
1 no symptoms	2 nausea	3 vomiting or moderate GI symptoms	4 diarrhea	5 severe anorexia
d) Functional capacity (nutritionally related functional impairment)				
1 none (improved)	2 difficulty with ambulating	3 difficulty with normal activity	4 light activity	5 bed-/chair-ridden with no or little activity
e) Comorbidity (MDH: Maximum duration of Hemodialysis)				
1	2	3	4	5
MDH <12 months and healthy otherwise	MDH 1-2 yrs or mild comorbidity	MDH 2-4 yrs age>75 or moderate comorbidity	MDH >4 yrs or severe comorbidity	very severe multiple comorbidity
(B) Physical Examination:				
a) Decreased fat stores or loss of subcutaneous fat (below eyes, triceps, biceps, chest)				
1 none (no change)	2	3 moderate	4	5 severe
b) Signs of muscle wasting (temple, clavicle, scapula, ribs, quadriceps, knee, interosseous)				
1 none (no change	2	3 moderate	4	5 severe

Total malnutrition score (sum of all)

MS score between 7-10 are considered as well nourished patients. MS score between 11-22 are considered as having mild to moderate malnutrition. Likewise score between 23 and 35 are considered as severely malnourished.[2,7]

All the patients who were enrolled in the study underwent different anthropometric measurements as well as laboratory investigations. All the anthropometric measurements were done after the dialysis. We measured Triceps skin fold thickness (TSF) with Verniers calipers and Mid arm circumference (MAC) with metal tape on the non-access arm. Mid arm muscle circumference (MAMC) was calculated with the formula: MAMC = MAC – (3.1415XTSF). Body mass index (BMI) was calculated as a ratio between end dialysis body weight in kilogram (Kg) and square of height in meter (m) (Kg/m^2).

Blood samples were taken just before the starting of hemodialysis for serum albumin, creatinine, urea, triglyceride, cholesterol and hematocrit. Post dialysis samples and pre dialysis blood sample of next session were drawn for blood urea. Urea reduction ratio (URR) was calculated with the formula: URR = 100 (1-post blood urea nitrogen (BUN)/pre BUN),[8] and the protein catabolic rate (nPCR) was calculated using the Gotch and Sargent equation.[9] The URR correlates with kt/v and can be used as an indicator of dialysis efficacy.[2,10]

Table-2: Anthropometric measurements of normal Nepali population (n=100)

	NORMAL ≥ 90% of 50th percentile (50th percentile)		
	ALL	**MALE**	**FEMALE**
BMI (kg/m2)	≥ 20.1 (22.3)	≥ 20.6 (22.9)	≥ 19.5 (21.7)
TSF (mm)	≥ 15.3 (17.0)	≥ 10.8 (12.0)	≥ 18.9 (21.0)
MAC (cm)	≥ 22.3 (24.7)	≥ 22.5 (25.0)	≥ 20.7 (23.0)
MAMC (cm)	≥ 17.5 (19.5)	≥ 19.1 (21.2)	≥ 15.3 (17.0)

Body mass index (BMI); Triceps skin fold thickness (TSF); Mid arm circumference (MAC); Mid arm muscle circumference (MAMC).

Anthropometric measurements on the non-dominant arm was done and BMI was calculated in 100 (50 males and 50 females) healthy subjects (age ranging 19-59 years) (Table-2) who served as control. BMI and anthropometric measurements were considered as normal when they were ≥90.0% of the fiftieth percentile of the control. Mild decrease was considered when the value of BMI and anthropometric measurements were between 80.0-90.0% of the fiftieth percentile of the control. Likewise, moderate decrease for BMI was defined as 70.0-79.0% of the fiftieth percentile and for anthropometric measurements as 60.0-79.0%. Severe decrease was defined when BMI was <70.0% and anthropometric measurements was <60.0% of the fiftieth percentile.[11]

Statistical analysis: All the data were collected and entered in Microsoft Excel. Mean and standard deviations were calculated. Independent 'T' test and Pearson's correlation were used with the help of SPSS ver. 11.5 software. P value of ≤0.05 was considered as significant except in correlation between MS and MAC and MS and MAMC where p value of ≤0.01 was taken as significant.

RESULTS

Total of 26 patients were included in the study. There were 16 male and 10 female patients. Average age of the patient was 42.58±16.32 years (range 19 to 74). Females were older than male patients (47±12.11 vs. 39.81±18.3 years). MS of the study population was

Table-3: Demographic data of the study population.

Parameters	All patients (n=26)	Male (n=16)	Female (n=10)	p value
Age (yrs)	42.58±16.32	39.81±18.3	47.0±12.11	0.28
Malnutrition score	15.62±3.76	15.06±3.55	16.5±4.12	0.35
Height (m)	1.58±0.08	1.63±0.07	1.51±0.05	0.00*
Weight (kg)	48.17±8.34	50.97±8.33	43.7±6.45	0.027*
BMI (kg/m2)	19.15±2.45	19.21±2.45	19.05±2.58	0.87
TSF (mm)	10.85±4.33	9.56±3.08	12.9±5.36	0.05*
MAC (cm)	20.63 ±2.47	21.25±2.61	19.65±1.94	0.11
MAMC (cm)	17.23±2.26	18.25±2.09	15.60±1.45	0.002*
TSF: MAC	0.052±0.019	0.045±0.011	0.065±0.023	0.008*
Serum albumin (mg/dL)	4.10±0.60	4.08±0.55	4.14±0.70	0.79
Serum creatinine (mg/dL)	9.95±2.41	11.04±2.13	8.20±1.73	0.002*
Hematocrit (%)	29.15±5.22	29.00±5.47	29.40±5.08	0.85
Cholesterol (mg/dL)	142.75±21.14	137.54±21.13	142.20±19.30	0.11
Triglyceride (mg/dL)	138.56±41.83	125.43±32.24	159.57±48.28	0.004*
Lymphocyte count (cumm)	2198.12±1004.54	2301±1091.1	2032.4±876.9	0.52
URR (%)	57.27±10.89	54.45±8.85	61.77±12.74	0.09
nPCR (g/kg/day)	0.77±0.28	0.81±0.30	0.71±0.24	0.35

Body mass index (BMI); Triceps skin fold thickness (TSF); Mid arm circumference (MAC); Mid arm muscle circumference (MAMC); Urea reduction ratio (URR); protein catabolic rate (nPCR). * Significant p value.

Table-4: Nutritional assessment of study population according to anthropometric measurements

Anthropometric measurements	Normal	Mild to moderate decrease	Severe decrease
BMI	11 (42.3%)	12 (46.1%)	3 (11.5%)
TSF	4 (15.38%)	9 (34.6%)	13 (50.0%)
MAC	8 (30.76%)	18 (69.2%)	0 (0%)
MAMC	10 (38.41%)	16 (61.5%)	0 (0%)

Body mass index (BMI); Triceps skin fold thickness (TSF); Mid arm circumference (MAC); Mid arm muscle circumference

15.82±3.76 (range 9-24). Female patients were having higher MS than males (16.5±4.11 vs. 15.06±3.55), the difference was however not significant. Based on MS score 22 patients (84.6%) had mild to moderate malnutrition (SGA score 11-22), 2 (7.7%) patients were having severe malnutrition (SGA score 23-35) and remaining 2 (7.7%) had normal nutrition score (SGA score 7-10).

Other demographic data are shown in Table-3. Mean BMI, mean MAC and mean MAMC showed mild malnutrition while mean TSF showed moderate malnutrition. Females were having lower BMI, MAC and MAMC but higher value of TSF. Table-3 shows significant sex specific differences in weight, height, MAC, serum albumin and blood cholesterol. Mean URR of the study population was 57.2±10.89%. URR was higher in females (61.77±12.74% vs. 54.45±8.85%). Six patients (23.0%) had URR of >65.0% and rest 20 (77.0%) had URR less than 65%. Out of 6 patients who had URR of >65.0% five were females. nPCR in our study was well below 1.2g/kg/day. nPCR was more in males than in females (0.81±0.30 g/kg/day vs. 0.71±0.24 g/kg/day).

Table-4 shows nutritional status of the study population according to anthropometric measurements that are BMI, TSF, MAC and MAMC. Eleven patients (42.3%) were having normal BMI (>90.0% of the 50th percentile of the control) while 12 (46.1%) had mild to moderate (70.0-90.0% of the 50th percentile of the control) decrease in BMI and remaining three (11.3%) had severe decrease (<70.0% of the 50th percentile of the control). Thirteen patients (50.0%) were having severe decrease in TSF (<60% of the 50th percentile of the control). Only 4 (15.4%) were having normal TSF (>90.0% of the 50th percentile of the control) and remaining 9 (34.6%) had mild to moderate decrease in TSF (60.0-90.0% of the 50th percentile of the control). None of the patients had severe decrease in MAC and MAMC (<60.0% of the 50th percentile of the control). Eight patients (30.8%) had normal MAC and 18 (69.2%) had mild to moderate decrease in MAC (60.0-90.0% of the 50th percentile of the control). Ten patients (38.1%) had normal MAMC (>90.0% of the 50th percentile of the control) and 16 (61.5%) had mild to moderate decrease in MAMC (60.0-90.0% of the 50th percentile of the control).

Table-5 shows that patients who were having higher MS were older than those patients who were younger. Patients who were well nourished based on MS also had normal BMI, MAC and MAMC. However, those patients having severe malnutrition according to MS had only moderate decrease in anthropometric measurements (BMI, MAC and MAMC).

Correlations were done between MS and other parameters of the patients. There was a significant correlation between MS and weight, BMI, MAC and MAMC showing lower BMI, MAC and MAMC having higher nutritional score and hence stronger tendency towards malnutrition. There was also a significant correlation between MS and nPCR (Table-6).

DISCUSSION

Malnutrition is a common problem in dialysis patients that increases morbidity and mortality in them. Based on SGA score developed by Kalantar-Zadeh *et al* we conducted our study. This score is very easy to perform and reliability of this score has been tested by different studies. Guidelines published in United States, United Kingdom and Europe all recommend its use to screen

Table-5: Relation between malnutrition score and anthropometric measurements.

Parameters	Normal nutrition MS score 7-10 (N=2; 7.7%)	Mild to moderate malnutrition MS score 11-22 (N=22; 84.6%)	Severe malnutrition MS score 23-35 (N=2; 7.7%)
Age	35±14.14	43.04±16.7	45±21.21
BMI	20.2±2.59	19.18±2.4	17.71±3.25
TSF	10±1.41	10.63±4.33	14±7.07
MAC	22.5±2.21	20.7±2.45	18±0
MAMC	19.35±2.56	17.36±1.96	13.6±2.22

Body mass index (BMI); Triceps skin fold thickness (TSF); Mid arm circumference (MAC); Mid arm muscle circumference (MAMC).

Table-6: Pearson's correlation and significance level between malnutrition score and other parameters.

Variables	Malnutrition Score	
	r	p value
Age (yrs)	0.28	0.166
Duration of dialysis	-0.36	0.074
Height (m)	-0.227	0.26
Weight (kg)	-0.453	0.02*
BMI (kg/m2)	-0.406	0.039*
TSF (mm)	-0.033	0.87
MAC (cm)	-0.496	0.01*
MAMC (cm)	-0.521	0.006*
TSF: MAC	0.148	0.47
Serum albumin (mg/dL)	0.25	0.218
Serum creatinine (mg/dL)	-0.022	0.916
Hematocrit (%)	0.276	0.172
Cholesterol (mg/dL)	0.117	0.568
Triglyceride (mg/dL)	-0.107	0.6
Lymphocyte count (cumm)	-0.07	0.72
URR (%)	0.194	0.342
nPCR (g/kg/day)	0.481	0.013*

Body mass index (BMI); Triceps skin fold thickness (TSF); Mid arm circumference (MAC); Mid arm muscle circumference (MAMC); Urea reduction ratio (URR); protein catabolic rate (nPCR). * Significant p value

malnutrition in renal patients.[12-15]

In our study most of the patients (84.6%) were having mild to moderate malnutrition. This may be because of inadequate dialysis as our patients undergo twice a week HD. Generally patients have poor appetite and even physicians are prescribing less amount of protein to them. In public hospitals poor appetite and hypermetabolism are deleterious for food intake.[5] In other studies the percentage of mild to moderate malnutrition ranged from 10.0% to 76.0%.[1,10,11] In India, Tapiawala *et al* reported 58.0% patients on hemodialyis being malnourished.[16] In a study by Morais *et al*, >90.0% of the patient were having malnutrition despite normal BMI and serum albumin.[5] Hemodialysis dose and frequency must be regarded as nutritional variables and prescribed accordingly.

Females had higher value of TSF but lower value of MAC and MAMC which may be due to increased amount of fat and lesser amount of muscle mass in them. In our study we had more patients having normal anthropometric measurements than when MS was considered. This may be because clinical dry weight and biochemical impedence analysis (BIA) derived dry weight differ in many situations. Clinical estimation of weight may be higher than BIA derived one so this may lead to false calculation of BMI and hence wrong interpretation of nutritional status.[5,17-19]

In our study, only 23.0% of the patients (n=6) had URR of >65.0%. Out of six patients five were females. In a study done in Pakistan URR was adequate in 31% only.[20] URR in females was more than in males which may be due to smaller body surface area. Some studies have shown that dialysis inadequacy is more common in males and those with larger body surface area. Our study population had dialysis insufficiency which was shown by URR of 57.27±10.9%. URR of >65.0% and kt/v of 1.2 is considered as adequate dialysis for HD patients. The URR correlates with kt/v and can be used as an indicator of dialysis efficacy.[2,10] When compared with a reference PCR of 1.2g/kg/day, patients with lower PCR values had more chances of having malnutrition.[11] Again, lower value of nPCR (<1g/kg/day) was associated with higher morbidity and mortality rate.[21] In a study by Reza Afshar *et al* patients having nPCR of <0.7 had 42.8% mortality.[2] As our study was only a cross sectional study we have not followed patients up so we could not find this relation.

There was a significant negative correlation between MS and BMI, MAC and MAMC. This explains that when anthropometric measurements decrease there is an increase in MS scores. We could not however find significant correlation between MS and age. Morais *et al*[5] and Afshar *et al*[2] also showed similar findings in their studies. In a study by Kalantar-Zadeh *et al*[7] there was significant correlation between MS and age which was not present in our study. It may be because our study population was small and study duration was short. There was no correlation between MS and gender and URR in our study which was not present in other studies also. This may be because urea modality depends on many assumptions such as constant protein intake.[2] Had we averaged URR over a long time we might have found correlation between URR and MS.

In our study we could not find correlation between MS and serum albumin. Serum albumin in our study was 4.10±0.60mg/dL. CH Jones *et al*[22] have reported in their study that 49.0% of normoalbuminemic persons were scored as malnourished and 54.0% of hypoalbuminemic persons scored as well nourished. Peter Stenvinkel *et al*[3] also reported having no significant difference in serum albumin levels between malnourished and well nourished ESKD patients. Serum albumin is considered as indicator of malnutrition but is not considered as reliable index. It is more associated with co-morbidities and inflammation.[3,11,22]

Malnutrition is very common in our center which is >90.0% when MS was used. This score is reliable and repeatedly tested and is very easy to perform especially in countries like ours where economic resource is very poor. In our study it negatively correlated with weight, BMI, MAC and MAMC. Dialysis inadequacy was present in 77.0% of our study population which shows that we need to increase the frequency of HD sessions in our patients. As nPCR is very low in our study population we may have high rate of morbidity and mortality. Further studies preferably multicentered ones are necessary to validate these finding.

ACKNOWLEDGEMENTS

We would like to thank Mr. P Pant, statistician, for his assistance in statistics and all those 100 volunteers (control) who gave consent for anthropometric measurements.

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