Holistic health assessment tool for patients on maintenance hemodialysis

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ABSTRACT

The recent emphasis on assessment of the psychological status, availability of newer and better methods of interpreting the anthropometric measurements of renal patients on dialysis therapy prompted the authors to develop the "Holistic Health Assessment Tool for dialysis patients (HHAT-D)." A total of 30 subjects (25–65 years), enrolled from dialysis centers in Mumbai were administered the HHAT-D tool to assess anthropometric, biochemical, functional, and psychological status (knowledge, needs, that coping strategies) along with dietary intake. The results showed that majority of the patients (73.3%) were mild to moderately malnourished. A highly significant negative correlation of anthropometric measurements (BMI, lean body mass, mid arm circumference, arm muscle area, bicep skin fold thickness, % usual body weight, and % standard body weight) with the HHAT-D scores (P<0.01) confirmed the validity of the tool in assessing the degree of malnutrition. The poor health status of the patients was further confirmed by the average (40%) to poor (36.6%) flexibility status and poor dietary nutrient intake. Moderate (36.6%) to high (60%) coping effectiveness was recorded in the patients as assessed using the "coping effectiveness inventory." A high degree of interitem correlation (Cronbach's coefficient alpha-test value 0.836) also proved the reliability of the HHAT-D tool. Thus, the HHAT-D was found to be a specific and reliable tool for assessment of holistic health status of patients on maintenance hemodialysis to improve quality of life and facilitate faster recovery.

Key words: Dialysis malnutrition score, dialysis, holistic health assessment tool, malnutrition

Introduction

Protein-energy malnutrition is prevalent in 16–54% of patients undergoing maintenance hemodialysis (MHD).[1-3] Subjective global assessment (SGA) is a tool that integrates various tests to derive a combined overall score of malnutrition[4] that has been used to determine the nutritional status of patients[5,6] and other populations at risk of protein energy malnutrition.[7] However, due to its subjective nature, Kalanter-Zadeh *et al*.[8] modified it into a fully quantitative scoring system called the dialysis malnutrition score (DMS) that is more reproducible and accurate.[9] Lowrie *et al*.[10] noted that increased psychological stress and related depression in 85% of dialysis patients was regarded as a major predictor of patient outcome and also influenced long-term compliance with diet and medication. Regular assessment of physical functioning and encouragement of increased physical activity are still given minimal attention within the nephrology community.[11] Thus, a need was felt by the authors to develop a new tool using additional subjective and objective tests to assess the holistic health of renal patients on MHD.

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Materials and Methods

Thirty subjects (13 males and 17 females) in the age group of 25–65 years and maintained on hemodialysis for ≥3 months were selected using purposive sampling technique after obtaining written informed consent. Patients in a disoriented state or with severe multiple complications were excluded from the study. The study protocol was approved by the Ethics Committee for Research in Human Subjects (ECRHS) of Seth G.S. Medical College and K.E.M. Hospital, Mumbai. The subjects were administered

the Holistic Health Assessment Tool (HHAT-D) as well as the DMS (modified SGA tool). The details of the scoring system for DMS and HHAT-D tools are given in Table 1.

Anthropometry and body composition

Various anthropometric indicators of body composition including BMI, percent usual body weight (%UBW) and percent standard body weight (%SBW), skin fold thickness [triceps (TSF), biceps (BSF), subscapular (SCSF), suprailiac (SISF)], body fat mass (BFM), lean body mass (LBM), and limb muscle measurements [midarm circumference (MAC) and arm muscle area (AMA)] were recorded.

Biochemical tests: Total protein, serum albumin, blood urea nitrogen, and hemoglobin levels were noted from patients' records.

Clinical assessment: In addition to GI symptoms, the presence and severity of respiratory symptoms were also recorded since impaired pulmonary function is associated with malnutrition and inflammation and predicts mortality in CKD patients.[12]

Dietary assessment: Dietary nutrient consumption and eating patterns of the patients were recorded using a 24 h diet recall.

Psychological assessment: A detailed questionnaire was used to assess knowledge about the disease, causes and dietary restrictions and needs (occupational, physical, social, emotional, spiritual, and financial) of the patients. The importance of learning to cope with stress in preventing severe malnutrition was evaluated using coping effectiveness inventory (CEI). This tool originally developed by Almeida and Agarwal[13] was modified to include 15 statements dwelling on the five themes such as containment of feelings, generation of hope, self esteem, relationships, and well being with score ranging from 15 (poor) to 60 (high). Three statements related to each of the five themes were included containing two negative and one positive statement [Table 2] that were graded according to the scale [Table 3].

Assessment of functional capacity: The subjects were asked to perform a simple test for flexibility i.e. "sit and reach test"[14] to understand readiness for initiating exercise program among them.

In addition to the seven parameters of DMS (Asgarani *et al*. 2004), patients were scored on two additional parameters including respiratory symptoms and coping effectiveness inventory. Each component had a score from 1 (normal) to 5 (very severe) thereby obtaining scores ranging from

Table 1: Salient features of the DMS and HHAT-D

Dialysis malnutrition score[9]	Holistic health assessment tool for dialysis patients scores
I) Weight change	I) Weight change
1: No weight change or weight gain	1: No weight change or weight gain
2: Minor weight loss <5%	2: Minor weight loss <5%
3: Weight loss 5-10%	3: Weight loss 5-10%
4: Weight loss 10-15%	4: Weight loss 10-15%
5: Weight loss >15%	5: Weight loss >15%
II) Dietary intake	II) Dietary intake
1: No change	1: No change
2: Suboptimal solid diet	2: Suboptimal solid diet
3: Full liquid diet or moderate overall decrease	3: Full liquid diet or moderate overall decrease
4: Hypo-caloric liquids	4: Hypo-caloric liquids
5: Starvation	5: Starvation
III) Gastrointestinal symptoms	III) Gastrointestinal symptoms
1: No symptoms	1: No symptoms
2: Nausea	2: Nausea
3: Vomiting or moderate GI symptoms	3: Vomiting or moderate GI symptoms
4: Diarrhea	4: Diarrhea
5: Severe anorexia	5: Severe anorexia
IV) Functional capacity	IV) Respiratory symptoms
1: Improved	1: No symptoms
2: Difficulty with ambulation	2: Cough
3: Difficulty with normal activity	3: Wheezing/Shortness of breath
4: Light activity	4: Coughing up blood/crowing sound while breathing
5: Bed ridden with little or no activity	5: Pneumonia
V) Co-morbidity	V) Functional capacity
1: MDH* < 12 months and healthy otherwise	1: Improved
2: MDH 1-2 y or mild co-morbidity	2: Difficulty with ambulation
3: MDH 2-4 y, Age 75 years or moderate co-morbidity	3: Difficulty with normal activity
4: MDH>4 y or severe co-morbidity	4: Light activity
5: Very severe multiple co-morbidity	5: Bed ridden with little or no activity
Physical examination	VI) Co-morbidity
VI) Decreased fat stores or loss of subcutaneous fat	1: MDH<12 months and healthy otherwise
1: None (no change)	2: MDH 1-2 y or mild co-morbidity
3: Moderate	3: MDH 2-4 y, Age 75 years or moderate co-morbidity
5: Severe	4: MDH>4 y or severe co-morbidity
VII) Signs of muscle wasting	5: Very severe multiple co-morbidity
1: No change	Physical examination
3: Moderate	VII) Decreased fat stores or loss of subcutaneous fat
5: Severe	1: None (no change)
	3: Moderate
	5: Severe
	VIII) Signs of muscle wasting
	1: No change
	3: Moderate
	5: Severe
	IX) Coping effectiveness inventory
	1: Good/high
	3: Moderate
	5: Poor/low
1-11=well nourished	1-15=well nourished
12-24=mild to moderately malnourished	16-30=mild to moderately malnourished
25-35=severely malnourished	31-45=severely malnourished

*MDH: Maximum duration of hemodialysis, DMS: Dialysis malnutrition score, HHAT-D: Holistic health assessment tool

9 (well nourished/normal) to 45 (severely malnourished) [Table 3]. Patients with the lower score were considered to have near normal nutritional status while those with higher scores had greater risk of complications.

Statistical analysis

Data were analyzed using descriptive statistics including frequencies, percentage, mean, S.D. and advanced statistics such as Pearson's correlation coefficient test to assess the strength of association between the variables using SPSS (version 12.0). Reliability of the HHAT-D was tested using Cronbach's coefficient alpha test.

Results

HHAT-D was found to be as effective as the DMS in determining the extent of malnutrition among the patients as there was no major difference in the percentage of patients identified at different levels of malnutrition [Figure 1]. According to the %UBW, majority (46.6%) of the subjects were found to have mild to moderate malnutrition whereas the %SBW was within the normal range. The HHAT-D scores showed a highly significant negative correlation with anthropometric parameters such as BMI, LBM, MAC, AMA, BSF, %UBW, and %SBW ($P<0.01$) [Table 4]. Also, loss of subcutaneous fat showed a significant negative correlation with the body fat mass ($P<0.05$) calculated from the skin fold measurements at four sites. Similarly subjective evaluation of muscle wasting correlated significantly and negatively with the lean body mass measurements ($P<0.05$).

No significant correlation was found between the HHAT-D scores and biochemical parameters, except for total protein that showed a significant negative correlation ($P<0.05$) indicating that low serum protein was associated with greater malnutrition. The mean serum albumin level (3.32 g %) was toward the lower range of the normal value 3.5–5.0 g% [Table 4]. The BUN values were found to be higher than normal while haemoglobin levels were found to be much lower than normal range in the patients [Table 4]. Cough (26.6%) and shortness of breath (46.6%) were the most commonly reported respiratory symptoms in the subjects.

Nutrient intake showed a negative but non significant correlation with HHAT-D scores indicating that poor

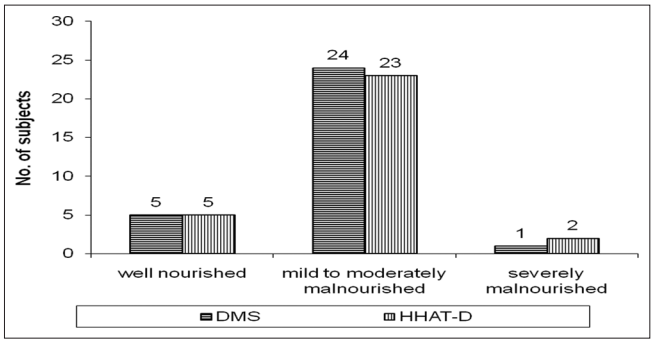

Figure 1: Degree of malnutrition assessed using the dialysis malnutrition score (DMS) and holistic health assessment tool for dialysis patients (HHAT-D)

Table 2: Modified coping effectiveness inventory

Sr. no.	Statement	1	2	3	4
1	I cannot talk about my fears				
2	I feel so mad and angry that I feel like hitting or smashing things/I have crying spells or feel like it				
3^	No matter what, I have the strength to hold myself together.				
4	Each time I feel ill, I feel I may not live long				
5	I feel that something bad is going to happen				
6^	I feel hopeful about the future.				
7	I am not able to do things as well as most other people do.				
8	I feel that I have no good qualities/I feel that I am a failure				
9^	I have respect for myself				
10	I do not attend social functions				
11	I do not make conversations with other patients				
12^	I still remain in touch with my friends and relatives				
13	I want to lie down in the bed most of the time even when I am not hospitalized				
14	I do not do routine things for myself, even if I can				
15^	I still care about my appearance				

^Positive statements

Table 3: Scoring system for coping effectiveness inventory[13]

Scale for negative statements	Scale for positive statements	Total CEI scores	CEI category for HHAT-D
4=not at all	1=not at all	15-30=poor coping	5=poor coping
3=to a small extent	2=to a small extent	31-45=moderate coping	3=moderate
2=to a moderate extent	3=to a moderate extent	46-60=high coping	1=good
1=to a large extent	4=to a large extent		

CEI = Coping effectiveness inventory

Table 4: Correlation between HHAT-D scores and various objective tests

Objective tests	Mean±SD	HHAT-D scores	*P* value
% Usual body weight	86.28 ± 9.31	−0.626**	0.000
% Standard body weight	93.76 ± 13.82	−0.516**	0.003
LBM (kg)	39.78 ± 8.28	−0.559**	0.001
Body fat (%)	22.37 ± 6.27	−0.423*	0.020
MAC (mm)	248 ± 366	−0.782**	0.000
AMA (mm^2)	2989 ± 1052	−0.763**	0.000
BMI (kg/m^2)	20.34 ± 3.11	−0.746**	0.000
Bicep skin fold (mm)	3.59 ± 1.54	−0.553**	0.002
Tricep skinfold (mm)	9.15 ± 3.7	−0.332	0.07
Total protein (g%)	6.1 ± 0.73	−0.405*	0.096
Serum albumin (g%)	3.32 ± 0.35	0.140	0.461
BUN (mg/dL)	91.51 ± 29.2	0.014	0.941
Hemoglobin (g%)	9.1 ± 2.02	0.042	0.826

HHAT-D = Holistic health assessment tool

food intake in terms of both macronutrients as well as micronutrients lead to the high degree of malnutrition among the patients. However, potassium was consumed in much larger quantities through the diet than recommended [Table 5]. Psychological assessment revealed moderate (36.6%) to high (60%) coping effectiveness in the patients [Table 6] which showed significant negative correlation with HHAT-D scores ($r=-0.418$, $P<0.05$) indicating that poor ability to cope with stress was associated with severe malnutrition and/or vice versa. Simple Flexibility test (sit and reach) to assess functional capacity showed average (40%) to poor (36.6%) flexibility level [Table 7] and a positive correlation with the HHAT-D scores, though non-significant. The Cronbach's alpha score for HHAT-D (0.836) was found to be similar to that of DMS (0.832).

Discussion

The institution of appropriate medical and nutritional care for the patients could be delayed due to underestimation of the degree of malnutrition, giving rise to increased health risks.

The HHAT-D included measurement of the %UBW and %SBW of the patients as per guidelines of the National Kidney Foundation Kidney Disease Outcomes Quality Initiative[15] to help predict the level of malnutrition. The negative correlation between HHAT-D scores and most of the anthropometric parameters indicated compromised nutritional status among the patients [Table 4]. Similar observations have been made by Asgarani *et al*.[9] using the DMS. The determination of LBM and BFM values included in HHAT-D provided for more critical assessment of body composition and can serve as a reference when long term nutritional follow-up is desirable.[16]

Hypoalbuminemia, as observed in most subjects [Table 4], is highly predictive of future mortality risk when present during the course of MHD.[17,18] Higher than normal BUN values and very low hemoglobin levels as noted in the HHAT-D helped to pay attention towards metabolic disturbances requiring immediate medical supervision. The NKF KDOQI workgroup have emphasized the importance of treating patients to hemoglobin of greater than 11 g%[19] and hence essential with analyze and monitor.

The frequency and duration of gastrointestinal and respiratory symptoms have an impact on the nutritional status. Poor respiratory function which is reflective of impact of malnutrition and inflammation on respiratory muscle performance influences clinical outcome[12] but was not part of the modified SGA tool and hence considered in the HHAT-D. In subjects who developed nausea, vomiting, cough, shortness of breath and pneumonia, poor respiratory functions persisted for >2 weeks further causing sleep disturbances and compromising physical activity functioning.

Anorexia and restriction of certain foods that are rich in water-soluble vitamins owing to their high potassium content[20] lead to poor food intake and thereby low nutrient intake among renal patients. In the present study also, the average dietary consumption of total calorie, protein, fiber and several micronutrients was found to be much lower than the recommended level while fat intake of the subjects was adequate [Table 5]. Anemia is a very common problem among CKD patients caused by the deficiency of erythropoietin and/or iron.[21] Ensuring sufficient iron intake through diet could be considered in the management of anemia, though intravenous infusion of iron is unavoidable in certain cases. Patients are also advised to consume micronutrient supplements to avoid deficiency. Hypercalcemia in hemodialysis patients resulting from excess calcium and phosphorous intake increases risk of calcification of soft tissues.[22] Hence, the calcium needs are individualized based on careful evaluation of serum calcium and phosphorous levels, use of supplements, phosphate binders, dialysate calcium concentration and sufficiency of dietary intake. Individualized attention to the calcium and iron needs of the patients is necessary due to the changes in mineral metabolism in order to plan suitable management strategies.

Taskapan *et al*.[23] opined that evaluation of psychological status should be part of the care provided to hemodialysis

Table 5: Average nutrient intake of the subjects

Nutrient	RDI#	Average intake	Nutrient	RDI	Average intake
Calorie (kcal/kg/day)	≥35	22.5 ± 6.3	Folic acid (mcg/day)	100	114.9 ± 66.5
Protein (g/kg/day)	1.0-1.2	0.6 ± 0.26	Vitamin C (mg/day)	60	13.0 ± 9.8
Carbohydrate (g)	%NPC*	177.3 ± 53.2	Iron (mg/day)	≥10-18	13.4 ± 9.4
Fat (g)	30-40	33.7 ± 7.6	Calcium (mg/day)	1400-1600	350.9 ± 164.7
Retinol (mcg/day)	600	79.9 ± 36.9	Phosphorous (mg/kg/day)	8-17	15.5 ± 5.4
Beta-Carotene (mcg/day)	2400	187.2 ± 96.5	Sodium (mg/day)	750-1000	73.1 ± 40.5
Niacin (mcg/day)	20	7.5 ± 3.4	Potassium (mg/day)	156-273	621.9 ± 95
Pyridoxine (mg/day)	5	0.1 ± 0.1	Zinc (mg/day)	15	4.3 ± 2.5

#RDI = Recommended dietary intake for HD patients (Source: Wilkins 2004),[29] *percent non protein calories

Table 6: Coping effectiveness inventory scores and grading of the patients

Coping effectiveness (Scores and grading)	Frequency (%)		
	Overall frequency (%)	Males (%)	Females (%)
Low (15-30)	1 (5.9)	-	1 (5.9)
Moderate (31-45)	11 (36.6)	4 (30.8)	7 (41.2)
High (46-60)	18 (60)	9 (69.2)	9 (52.9)

Table 7: Mean flexibility scores of subjects

Flexibility scores	Frequency (%)
Excellent (+3 to +5)	Nil
Good (+2 to +3)	7 (23.3)
Average (0 to +1)	12 (40)
Poor (−1 to −5)	11 (36.6)
Very poor (−6 to −15)	Nil

patients. This contention was supported by other experts who observed chronic depression among dialysis patients and other psychiatric disorders having an impact on overall quality of life.[24] Knowledge about the clinical condition can serve as a key element to overcome stress since patients gain a sense of control over their experiences and environment and helps reduce feelings of vulnerability,[25] whereas lack of awareness can lead to patients harboring wrong notions and faulty beliefs further hindering recovery. Current study recorded poor knowledge base and inadequate information about the disease condition and associated dietary changes among the patients. Interestingly, women were less vocal about their needs as compared to men and both the sexes showed high social and emotional needs which would help them tide over the stressful state more easily. The CEI tool has been found to be reliable (Cronbach's alpha 0.80) and valid for assessment of coping strategies among Indian population suffering from end stage renal disease.[13] In the present study, the total CEI scores revealed that better coping was associated with lower degree of malnutrition for both the sexes [Table 6] thereby highlighting the need to pay attention to this vital aspect of nutritional status. Ersoy-Kart and Guldu[26] reported lower coping scores and greater vulnerability to stress among 55 patients receiving HD in Turkey.

The reduced physical capacity and activity level in hemodialysis patients as assessed through the flexibility test [Table 7] may be responsible for the increased incidence of depression observed among them which reduces the patients' ability to perform familiar pleasant activities.[27]

Steiber *et al*.[28] opined that establishing the validity and reliability of each version of nutritional assessment tool in different patient populations is very essential to facilitate correct application of the same by clinicians and researchers. The Cronbach's coefficient alpha-test showed a high degree of inter-item correlation indicating a high internal consistency of each item in the tool. The reliability scores signify that the items in the tool (anthropometry, body composition, etc) truly measured the construct (assessment of health status) they were aimed to measure. Also, the selected objective tests showed significant negative correlation with the HHAT-D scores (based on subjective evaluation) thereby enhancing the validity of the tool.

Thus, the Holistic Health Assessment Tool for Dialysis patients (HHAT-D) can be considered as a valid and reliable tool which throws light on the various crucial indicators of malnutrition associated with kidney dysfunction and hence can be used to improve the overall quality of life of these patients. However, there is a need to further assess the inter and intra-observer reliability as well as validity of the HHAT-D tool by administering it on larger subject population with the help of more comparative and longitudinal studies.

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