TITLE: Nutritional assessment of patients on maintenance hemodialysis using Dialysis Malnutrition Score (DMS)

AUTHORS: Jo-Ann Rene V. Boado MD (2), Divina Cristy Redondo MD (1), Jovi Flauta-Orio MD (2), Ma. Lourdes M. Gomez MD (2), Aurora Valencia RND (1), Michelle Joy Ingalla RND (1), Romelle M. Ferrer RN (1)

INSTITUTION WHERE STUDY WAS CONDUCTED:
1. Medical Nutrition and Weight Management Center, Premiere Medical Center, Nueva Ecija, Philippines
2. Department of Internal Medicine, Premiere Medical Center, Nueva Ecija Philippines

ABSTRACT

BACKGROUND: Malnutrition is prevalent among dialysis patients and a strong association exists between poor nutritional status and morbidity and mortality in patients with end-stage renal disease who are treated with hemodialysis.

OBJECTIVE: This study aimed to determine the prevalence of malnutrition of MHD patients at a dialysis center in a provincial hospital in the Philippines using the Dialysis Malnutrition Score (DMS), another modified Subjective Global Assessment (SGA). It also aimed to analyze possible correlation between dialysis malnutrition score and different techniques of nutritional assessment including food intake and anthropometric measurement.

METHODOLOGY: This is a prospective observational study in which the MHD patients were nutritionally assessed by modified SGA dialysis malnutrition score, food intake recall and anthropometry.

RESULTS: 45% have moderate malnutrition and 36% have severe malnutrition. The severity of malnutrition was not associated with age, and duration of dialysis while food intake and anthropometric variables have weak negative correlation.

CONCLUSION: Thirty sex percent of MHD patients are severely malnourished and this is not associated with the duration of dialysis.

RECOMMENDATION: More comparative, longitudinal studies with larger population are needed to further validate the reliability of DMS.

KEYWORDS: anthropometric; maintenance hemodialysis; malnutrition score; subjective global assessment
INTRODUCTION

Malnutrition is common among patients on maintenance hemodialysis. A 40% prevalence of malnutrition was found in patients with advanced renal failure at the beginning of dialysis treatment (1). As shown by several cross-sectional studies in the United States, Japan, and Europe, end-stage renal disease (ESRD) patients treated by maintenance hemodialysis (MHD) are at risk of malnutrition. In fact, virtually every study examining the nutritional status of hemodialysis patients indicates that such patients frequently manifest protein-energy malnutrition (2). Protein-energy malnutrition (PEM) is one of prevalent complications appearing in patients undergoing hemodialysis (3, 4). With reported annual mortality rates range from 23.6% in the United States in 1993 (5), to 10.7% in Europe (6), and to 9.5% in Japan in 1994 (7), a common factor of increased death risk in these populations is malnutrition (8).

Fundamental for preventing, diagnosing and treating protein-energy malnutrition on dialysis patients is the periodical monitoring of the nutritional status. Early identification and treatment of nutritional deficit can reduce the risk of infections, other complications, and mortality for those patients (9). However, assessment of nutritional status is frequently ignored in many dialysis centers (10) because of the difficulty of an accurate determination of the nutritional status in HD patients, which depends on indirect methods. The accuracy of some nutritional markers used in nutrition assessment is also questionable (11,12). The reliable assessment of nutritional status requires multidisciplinary procedures including anthropometric measurements, body composition measurements, biochemical measurements, functional assessments, dietary assessments, and subjective assessments. However, most of these procedures are time-consuming and cumbersome (13) and in a rural setting, it can be costly. The subjective global assessment (SGA) was designed to circumvent many of these problems (14,15), but its semi-quantitative scale consisting of only three discrete severity levels restricts its reliability and precision (16). Using the conventional SGA, Kalantar-Zadeh et al (16) developed a fully quantitative scoring system for dialysis patients which they concluded can be performed in minutes and can reliably assess the nutritional status of patients on hemodialysis. SGA is a structured assessment of the nutritional status based on a concentrated history and physical examination [17,18]. Five features of the history are elicited, the amount and pattern of weight loss in the previous six months, changes in dietary intake, gastrointestinal symptoms, functional capacity or energy level and metabolic demands of the patient's condition. The features in the physical examination are loss of subcutaneous fat, muscle wasting, edema and ascites. However, the presence of edema or ascites of the original SGA physical examination are usually not used for dialysis patients. Hence, using the components of the conventional SGA, a quantitative scoring system called Dialysis Malnutrition S core (DMS) was developed. (19) DMS consists of seven components of the conventional SGA: weight change, dietary intake, GI symptoms, functional capacity, co-morbidity, loss of subcutaneous fat, and signs of muscle wasting, and number of years of dialysis therapy was added to the co-morbidity component.

This study aimed to determine the prevalence of malnutrition of MHD patients with chronic kidney failure at a dialysis center in a provincial hospital in the Philippines using the Dialysis Malnutrition Score (DMS), another modified Subjective Global Assessment. This study also
aimed to analyze possible correlations between modified SGA and different techniques of nutritional assessment including food intake and anthropometric measurements.

**METHODOLOGY**

Patients

This study was conducted on 33 patients between May 2010 to October 2010 at a dialysis center in Premiere Medical Center (PMC), Nueva Ecija, Philippines. Criteria for inclusion in the study are: 18–85 years old males and females who are on hemodialysis (HD) for at least 1 month, receiving oral diet, without incidental infection, and access via arterio-venous fistula. The exclusion criteria are as follows: presence of sepsis, shock, multiple organ failure, coma, clinical or surgical hospitalization in the last 30 days, with ongoing enteral and parenteral nutrition, use of steroidal or non-steroidal anti-inflammatory or immune-suppressive agents, cardiac pacemaker. Patients received daily treatment prescribed by their physicians which include anti-hypertensive medications, phosphate binding, erythropoietin, iron medications and vitamin supplements. Before joining the study, written informed consent was obtained from the participants.

Food Intake

Dietary recall forms, which include two-day food intake in midweek and one-day intake on weekends, were gathered by trained clinical dietitians. The calorie and protein consumed by the patients were compared with the recommended daily calorie and protein requirements based from the American Society for Parenteral and Enteral Nutrition (ASPEN) guidelines.

Anthropometric measurement

Body dry weight and skin–fold measurements were performed after termination of the dialysis session. Triceps skin–fold (TSF) was measured with skin–fold caliper. Mid-arm circumference (MAC) was measured using a tape measure. All the above measurements were performed three times on the non-access arm of each dialysis patient and the average result of the three measurements was registered as the final result. Mid-arm muscle circumference (MAMC) was derived according to the following formula: $\text{MAMC} = \text{MAC} - (0.31415 \times \text{TSF})$. Body mass index (BMI) was calculated as the ratio between end dialysis body weight in kilogram and the square of height in meter.

Dialysis Malnutrition Score (DMS)

Dialysis malnutrition score consists of seven features: weight change, dietary intake, GI symptoms, functional capacity, co-morbidity, subcutaneous fat and signs of muscle wasting was recently developed (see Table 1). Each component has a score from one (normal) to five (very severe). The malnutrition score (sum of all seven components) is a number between seven to 10 (normal) and 11-15 (moderate malnutrition) and 16-35 (severe malnutrition). A lower score denotes tendency towards a normal nutritional status while a higher score is considered to be
an indicator of the severity of malnutrition, that is, the higher the nutritional score, the stronger the tendency towards protein energy malnutrition. Table 1 shows the Dialysis Malnutrition Score consisting of two parts: 1.) patient’s related medical history (weight change, dietary intake, gastro-intestinal symptoms, functional capacity, co-morbidities) and 2.) physical examination (decreased fat stores or loss of subcutaneous fat and signs of muscle wasting). For weight change, the overall change in the post-dialysis dry weight was obtained. The lowest score of one was given if there was no weight change or if patient had gained weight. Score of two was given for minor weight loss (<5%), score of three for weight loss of 5-10%, score of four for weight loss of 10-15% and score of five for any weight loss over 15% the last 6 months. Dietary intake was scored one if it was considered as a regular solid intake with no recent change in the amount or quality of the meals, two for sub-optimal solid diet, three for full liquid diet or any moderate overall decrease, four for hypocaloric liquid and five for starvation. Gastrointestinal (GI) symptoms were scored one if there was no symptom, two for nausea, three for vomiting or any moderate GI symptoms, four for diarrhea and five for severe anorexia. Functional capacity was scored one for normal functional capacity and/or any considerable improvement in the level of previous functional impairment, two for any mild to moderate difficulty with ambulation, three for difficulty with normal activity, four for restriction solely light activity and five for a persistent bed/chair-ridden state. The co-morbidity component of the SGA criteria was modified by incorporating the duration of hemodialysis and advanced age, which both have a bearing on nutrition. The co-morbidity was scored as one if there was no other medical problems and if the patient had been hemodialysed for less than one year; two if there was mild co-morbidity or if the patient has been dialyzed for one to two years; three if there was moderate co-morbidity or if the patient had been dialyzed for two to four years, or if the patient was >75 years of age; four if there was severe co-morbidity or if the patient had been dialyzed for over four years; and five if there were very severe, multiple co-morbidities. Physical examination in DMS and is composed of two sections: subcutaneous fat and muscle wasting (Table 2). Body fat stores (subcutaneous fat) were scored by assessing subcutaneous fat deposition in four body areas: below the eyes, triceps, biceps and in the chest area. Signs of muscle wasting were obtained by briefly examining seven sites: temple, clavicle, scapula, ribs, quadriceps, knee and interosseous muscles. For each of these two components a score of one to five, representing normal to very severe changes, was assigned according to subjective assessment of the examiner. After completion of physical examinations, patients were classified in one of three groups: normal, moderate malnutrition and severe malnutrition. Total nutritional scoring for each patient was assessed within five to 15 minutes.

Nutritional assessment using modified SGA was also performed in all 33 patients on maintenance hemodialysis. To gain maximum benefit of the reliability of the modified SGA, three selected and properly trained staff performed the assessment.

Statistical Analysis

Answers to categorical variables were tabulated and overall and gender specific mean and standard deviation of continuous variables were obtained. For gender comparisons, Wilcoxon’s rank sum test was utilized. Fischer’s exact test was used to determine if severity of malnutrition...
is associated with gender. Lastly, Pearson’s correlation was used for the malnutrition scores and the select study variables.

### Table 1. Dialysis Malnutrition Score

#### A. Patients related medical history:

1. **Weight change (overall change in past 8 months)**

   - **1**: No weight change or gain
   - **2**: Minor weight loss (<5%)
   - **3**: Weight loss 5 to 10%
   - **4**: Weight loss 10 to 15%
   - **5**: Weight loss >15%

2. **Dietary intake**

   - **1**: No change
   - **2**: Sub-optimal solid diet
   - **3**: Full liquid or moderate overall decrease
   - **4**: Hypo-caloric liquid
   - **5**: Starvation

3. **Gastrointestinal symptoms**

   - **1**: No symptoms
   - **2**: Nausea
   - **3**: Vomiting or moderate GI symptoms
   - **4**: Diarrhea
   - **5**: Severe anorexia

4. **Functional capacity (nutritionally related functional impairment)**

   - **1**: None (improved)
   - **2**: Difficulty with ambulation
   - **3**: Difficulty with normal activity
   - **4**: Light activity
   - **5**: Bed-chair ridden with no or little activity

5. **Co-morbidity**

   - **1**: MDH < 12 months and healthy otherwise
   - **2**: MDH: 1-2 years or mild co-morbidity
   - **3**: MDH: 2-4 years or age >75 or moderate co-morbidity
   - **4**: MDH > 4 years or severe co-morbidity
   - **5**: Very severe multiple co-morbidity

#### B. Physical Exam

1. **Decreased fat stores or loss of subcutaneous fat (below eyes, triceps, biceps, chest)**

   - **1**: None
   - **2**: Moderate
   - **3**: Severe

2. **Signs of muscle wasting (temples, clavicle, clavula, ribe, quadriceps, knee, interosseous)**

   - **1**: None
   - **2**: Moderate
   - **3**: Severe

---

Abbreviation: SGA, subjective global assessment; MDH, maximum duration of hemodialysis. *Five scale parameters are employed and the values are summed. A value of 7 is normal, while 35 is the most severe malnutrition.*
RESULTS

A total of 33 patients out of 43 patients were included in the study. Ten patients were excluded because of the following reasons: one patient is below 18 years of age, five had recent infection and were subsequently admitted, two patients received enteral nutrition and two patients had hemodialysis for less than two weeks only. Majority of the subjects were males (61%). For co-morbidities, the most common among patients with chronic renal failure was hypertension (79%) followed by coronary artery disease (58%) and diabetes mellitus (52%). Most of the
patients took iron supplements (55%) and calcium supplements (79%). For frequency of dialysis, a large proportion underwent dialysis twice a week (88%). There were only a few who experienced loss of appetite before, after or during dialysis but 52% of them reported nausea/vomiting.

In Table 4, overall and gender specific summary statistics of continuous variables are presented. Using the Wilcoxon rank sum test, we see that the difference between gender for weight (pre and post dialysis) and height are statistically significant. For the rest of the variables, they are comparable in distribution for males and females.
Using the modified SGA, 45% of the study participants have moderate malnutrition and 36% have severe malnutrition. Only 18% of them have modified SGA score within the normal range. There are more males than females with moderate to severe scores. However, using Fisher’s exact test, severity was shown to be not associated with gender (p-value:0.266).

The dialysis malnutrition scores were correlated with age, duration of dialysis, food intake and anthropometric variables. The scatter plots are shown in figures 1 below. The pair-wise correlation between age of the patient and malnutrition score is approximately equal to zero indicating that these two variables are not correlated. For duration of dialysis, the correlation index is also very small at 0.05.

Food intake and anthropometric variables are all negatively correlated with the modified SGA malnutrition score. Among these variables, TSF (mm) has the largest index at -0.34. The value however only signifies a relatively weak negative correlation between triceps skin-fold thickness and malnutrition score (p-value:0.06). Body mass index also has a relatively large correlation index at -0.31 (p-value: 0.08) also indicating a weak negative correlation.
In figures below, there is no clear linear trend that can be seen. For BMI and TSF in figures 1.F and 1.G, respectively, a weak inverse relationship is implied. As malnutrition score increases, BMI and TSF values decrease. In figures 1.a and 1.b, there is clearly no trend or association between the variables. In figures 1.C and 1.D, the values appear to form a horizontal strip in the graph indicating a linear but weak linear association. There appears to be no trend in figure 1.E and a slightly inverse trend in figures 1.H and 1.I.
DISCUSSION

Malnutrition is common in dialysis patients (14,15,16) and predicts morbidity and mortality (30,31). Nutritional assessments in dialysis patients are imperative, although the task is not necessarily easy. The purpose of such assessment is obviously the identification of patients at risk for complications and a poor outcome before such complications have developed especially with onset of protein energy malnutrition. This allows the implementation and preventive interventions, such as additional nutritional counseling, dietary supplements or psychosocial interventions. Furthermore, routine monitoring of the nutritional status of dialysis patients is more important because protein –energy wasting and malnutrition is more difficult to treat when it is severe. Early detection of the first signs of protein energy malnutrition allows early treatment to anticipate nutritional depletion, and, most importantly to prevent any further deterioration (32). Nevertheless, the nutritional status of dialysis patients is frequently ignored and has rarely been a subject of research until today (33). Several indices of malnutrition are available ranging from the well-known anthropometric measurements (34) to more elaborate techniques such as DEXA and bioelectrical impedance (35,36). However, the reliability of these methods in detecting protein-calorie malnutrition and their practicability has not been shown (27,37). Moreover, these methods are costly and may not be applicable in our hospital set-up. Studies by Baker et al. (18), Detsky and colleagues (38) and Jeejeebhoy and colleagues (39,40), suggest that the SGA not only determines the nutritional status, but also predicts the likelihood of complications in terms of sickness. A fully quantitative malnutrition scoring system (dialysis malnutrition score), derived from conventional SGA was used to answer the practicability our HD patients need. DMS is easy, practical, yet reproducible, guidelines for each single scoring component. It allows a rapid, equipment-free scoring on nutrition status in patients with renal failure. The test uses a simple history and physical examination which can be performed by a physician, dietician or trained nurse (17,27). The method is closely correlated with more objective measures (17).
In this study, 45% have moderate malnutrition and 36% have severe malnutrition using the modified SGA. The severity of malnutrition was not associated with age and duration of dialysis. But using the modified SGA dialysis malnutrition score, we determined a negative correlation between malnutrition, food intake, BMI and TSF. Although indicating a weak negative correlation, body mass index has a relatively large correlation index. Among indicators of body mass, BMI is the most commonly used measure of weight-for-height (41-43) and may be used to assess malnutrition. However, BMI can be heavily influenced by fat mass or hydration status. Nonetheless, a low BMI is a consistent predictor of poor outcome and high death risk in maintenance dialysis patient (44-45). However, a low BMI may not indicate pathology in some population such on those from Southeast Asia (46-47) like the Philippines. Food intake specifically dietary energy and protein intake has negative correlation with the Modified SGA Dialysis Malnutrition Score as well. An unintentional reduction in dietary protein intake less than about 0.80 gm per kg body weight per day in maintenance dialysis patients and dietary intake less than about 25 kcal per kg body weight per day in maintenance dialysis patients and dietary energy intake less than about 25 kcal per kg body weight can be associated with protein energy wasting. (48) Improved patient outcome may highly be observed if there will be an increased attention to the nutritional status of the patient on maintenance hemodialysis. However, before we can test for any nutritional intervention among MHD patients, it is important that we can assess their nutritional status with a standardized, validated and generally accepted method.

CONCLUSION

The dialysis malnutrition score can be a potential and reliable nutritional assessment tool for MHD patients and may provide a standardized method in which large number of maintenance hemodialysis patients can be assessed by any trained member of the dialysis care and nutrition support team.

RECOMMENDATION

More comparative, longitudinal studies with larger population are needed with the recommendation to include not only anthropometric variables, dietary intake but to check for the biochemical parameters as well. This is to further validate the reliability of Dialysis Malnutrition Score.

REFERENCES

1. Fouque D and Kopple J. Malnutrition and dialysis In 1272-89.


