NUTRITIONAL ASSESSMENT OF PATIENTS WITH ADVANCED CHRONIC RENAL FAILURE

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ABSTRACT

Background: Malnutrition is an important risk factor for morbidity and mortality in patients with advanced chronic renal failure. Its prevalence has been estimated to range from 10 to 70% in patients on maintenance hemodialysis and 18 to 51% in patients treated by CAPD.

Objective: is to assess the nutritional status of patients with advanced chronic renal failure treated in the University Hospital including those on maintenance hemodialysis and those treated conservatively who underwent peritoneal dialysis as a life saving procedure.

Patients & Methods: Fifty patients (25 on regular hemodialysis and 25 with chronic renal failure in whom peritoneal dialysis was done as an acute procedure) were studied. Their state of nutrition was assessed clinically, biochemically and by anthropometric measurements.

Results: The dietary intake was inadequate in 44 (88%) patients. Thirty-eight (76%) patients had clinically evident muscle wasting.
Body mass index, triceps skin fold thickness and mid-arm muscle circumference were below the standard in 62%, 82%, and 74% of patients respectively. Forty-seven (94%) patients were anemic. Albumin level was less than 4.0 gm/dl in 32 (64%) patients.

Conclusion: Malnutrition is common in our patients with advanced chronic renal failure. Simple anthropometric measurements are valuable in its diagnosis.

Keywords: nutrition, malnutrition, chronic renal failure, and dialysis.

Iraqi J Med Sci, 2004; Vol. 3 (1): 38-42

Introduction

Maintaining body protein or lean body mass is difficult in patients with chronic renal failure because raising dietary protein causes nitrogenous waste products to accumulate, whereas an inadequate intake of essential amino acids leads to loss of body protein[1]. Most studies that evaluated the nutritional status of patients with end-stage renal disease (ESRD) reported some degree of malnutrition. The prevalence has been estimated to range from 10 to 70% in patients undergoing hemodialysis and 18 to 51% in patients treated by continuous ambulatory peritoneal dialysis (CAPD)[2-5].

Several factors related to the uraemic state may contribute to the high incidence of protein-energy malnutrition in these patients. Among these factors inadequate nutrient intake is the most important. Other factors include nutrient losses during dialysis and protein catabolism induced by metabolic acidosis, intercurrent illnesses, the use of bio-incompatible membranes, and endocrine disorders like insulin resistance and raised parathyroid hormone[2,6-9].

Malnutrition is an important risk factor for morbidity and mortality. It is associated with an increased frequency of hospitalization with longer stay in hospital causing a three-fold increase in hospital costs. Malnutrition can result in more difficult dialysis treatments and an increased number of missed dialysis sessions[1,3,7,10,11].

The aim of this study is to assess the nutritional status of patients with advanced chronic renal failure in our practice in the University Hospital.

Patients & Methods

Fifty patients were studied. Twenty-five were patients with advanced chronic renal failure who underwent peritoneal dialysis once or more as a life saving measure (Group A). The other twenty five were patients on regular hemodialysis (Group B). Twenty-eight were males and 22 females.

Their protein intake was assessed by taking a dietary history from the patients or their close relatives. The intake was characterized as adequate or inadequate. Adequate intake was defined as consumption of at least 1 g protein/kg body weight/day. Consumption of less than this was considered inadequate. Clinical assessment also included looking for wasting in the facial and upper and lower limb muscles.

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Received 25th January 2003: Accepted 8th December 2003.
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Anthropometric measurements included body mass index (BMI), triceps skin fold thickness (TSF), midarm circumference (MAC) and midarm muscle circumference (MAMC).

A single observer performed all measurements according to published techniques. Measurements were done at the end of hemodialysis sessions for regular hemodialysis patients and at the next visit after dialysis for peritoneal dialysis patients.

Body mass index (BMI) was calculated as weight (in kilograms) divided by height (in meters) squared:

BMI = weight (kg)/ height (m)^2

The normal BMI is 20 to 25 for males, and 19 to 24 for females. For purposes of classification, arbitrary limits were established to further define BMI in underweight patients. Males with BMI of 19-19.9, 18-18.9, and less than 18 were considered mildly, moderately, and severely underweight respectively. Comparable measures for BMI in females are 18-18.9, 17-17.9, and less than 17[12,13].

Triceps skin fold thickness (TSF) was measured by a skin fold caliper, usually when patients were at dry weight. Measurements were taken on the arm that does not contain the vascular access midway between the acromion and olecranon processes.

The midarm circumference (MAC) was measured using a tape on the same site used for TSF measurements[12-17].

The midarm muscle circumference (MAMC) was calculated from MAC and TSF as follows:

MAMC (cm) = MAC (cm) – 0.314 x TSF (mm)

These anthropometric measurements were compared with reference standards. Standards are defined as the 50th percentile according to combined Health and Nutrition Examination Survey (HANES) I & II normative values. Values below the normal and above the 15th percentile indicate mild reduction; those between 5th-15th percentiles indicate moderate reduction, and values less than 5th. Percentile indicates severe reduction[14-20].

Biochemical tests were performed in the same clinical laboratory. Fasting samples were used for serum cholesterol estimation. Predialysis samples were taken to estimate levels of urea, creatinine, hemoglobin and albumin.

Hemoglobin concentration below 13Gm/dl in males and 12Gm/dl in females was used to define anemia. Anemia was considered mild if the hemoglobin was 9Gm/dl or more, moderate if it was 7-8.9Gm/dl and severe if it was below 7Gm/dl.

Serum albumin was regarded as normal if 4 gm/dl or more; in mild deficit at 3.5-3.9 gm/dl; in moderate deficit at 2.8-3.4 gm/dl; and severe deficit if less than 2.8 gm/dl[2].

Serum cholesterol level less than 150 mg/dl (3.8 mmol/L) was regarded an index of malnutrition[2,6,13].

The vast majority of patients received the usual medications including multivitamins, folic acid, ferrous sulphate, calcium salts and one-alfa cholecalciferol in addition to drugs used for any concomitant illnesses. No patient received erythropoietin (not available) or anabolic steroids.

Statistical analyses were made using the chi square (x^2), and student *t* test.

Results

The mean age of patients was 50±13 years (range 20 to 72 years). The mean blood urea values were 253.6±63.22 mg/dl and 235.4±53.53 mg/dl for group A and group B, respectively. The corresponding serum creatinine values were10.19±2.67 mg/dl, and 8.31±2.17 mg/dl. The dietary protein intake was inadequate in 88% of patients. Thirty-eight (76%) patients had clinically evident muscle wasting. Tables 1 and 2 summarize the anthropometric measurements of the two groups of patients.

Table 1: Anthropometric measurements in group A patients

Data	Mean±SD	No. of patients with			
		Mild *	Moderate*	Severe*	Adequate+
BMI Kgm/m^2	18.36±4.28	4	5	8	8
TSF (mm)	8.48±2.77	6	7	8	4
MAMC (cm)	17.95±2.82	5	9	6	5

* = mild, moderate and severe nutrition, + = adequate nutrition, BMI =body mass index, TSF =triceps skin fold thickness, MAMC =mid arm muscle circumference.

Table 2: Anthropometric measurement in group B patients

Data	Mean±SD	No. of patients with			
		Mild *	Moderate*	Severe*	Adequate+
BMI Kgm/m^2	20.65±4.85	6	4	4	11
TSF (mm)	7.82±2.44	7	5	8	5
MAMC (cm)	19.36±2.98	8	6	3	8

* = mild, moderate and severe nutrition, + = adequate nutrition, BMI =body mass index, TSF =triceps skin fold thickness, MAMC =mid arm muscle circumference.

No statistical differences in anthropometric measurements were noticed between group A and group B patients. Out of 50 patients 36 (72%) had two substandard measurements out of three according to combined Health and Nutrition Examination Survey (HANES) I & II nomogram values.

Haemoglobin and serum albumen levels in the two groups of patients are shown in table 3 and 4.

Table 3: Hemoglobin and albumin levels in group A patients

Data	Mean±SD	No. of patients with			
		Mild *	Moderate*	Severe*	Adequate+
Hb (gm/dl)	7.68±1.69	3	11	9	2
Albumin (gm/dl)	3.45±0.67	12	3	4	6

* = mild, moderate and severe reduction, + = normal Hb and albumin levels.

Table 4: Hemoglobin and albumin levels in group B patients

Data	Mean±SD	No. of patients with			
		Mild *	Moderate*	Severe*	Adequate+
Hb (gm/dl)	7.13±2.06	2	9	13	1
Albumin (gm/dl)	3.73±0.42	7	4	2	12

* = mild, moderate and severe reduction, + = normal Hb and albumin levels.

Anemia was the most common abnormality, encountered in 47 (94%) patients. Three patients with normal haemoglobin levels were on dialysis for less than few months. Albumin level was reduced to substandard levels (less than 4.0 gm/dl) in 32 (64%) patients. Serum cholesterol level was subnormal in 26 (52%) patients, normal (150–200 mg/dl) in 17 (34%) patients, and above normal in 7 (14%) patients.

Discussion

Malnutrition is an independent risk factor of morbidity and mortality in chronic renal failure patients. The nutritional aspect should therefore be an important part of their management[9,11,18,21,22]. Baker *et al* concluded that clinical assessment is a reproducible and valid technique for evaluating nutritional status and suggested that carefully performed history taking and physical examination are sufficient for nutritional assessment[23].

Forty four of the patients in this study (88%) consumed an inadequate dietary protein (< 1.0 g/kg/day). In contrast, Blumenkrantz et al found that the average daily protein intake of their dialysis patients was 88±21 g/day i.e.1.1±0.1 g/kg/day[12]. One reason for the inadequate diet in our patients is self induced restriction due to a wide spread belief among lay people that protein should be totally avoided in the presence of renal disease. Anorexia due to inadequate dialysis, intercurrent illnesses and the emotional impact of the disease and dialysis therapy is another reason. Clinically evident muscle wasting was present in 76% of patients, which is higher than it is in other studies[3,5,12,24].

Thirty one (62%) patients had substandard body mass indices (BMI). BMI was higher in the group of patients on regular hemodialysis though the difference did not reach statistical significance. The presence of ascitis in six of the patients may have been responsible for the difference. The use of BMI as an indicator of nutritional status is known to be unreliable in edematous patients[13,20]. Stefanovic *et al* have shown that patients with BMI<20.0 kg/m^2 have significantly more frequent hospitalizations and more hospital days per patient than those with BMI > 25.0 kg/m^2. The low BMI was also associated with a significantly lower dialysis adequacy and more severe anemia[25].

Measurement of skin fold thickness is used widely to estimate body fat. It is inexpensive, reproducible, relatively easy to learn and perform and can be carried out quickly[14,15,16,19]. Triceps skin fold thickness (TSF) was below the standard in 41(82%) patients. Others reported a figure of 72%[13] and 62%[14] and found it directly related to other nutritional parameters.

Previous observations indicated that measurement of mid arm muscle circumference

(MAMC) reflected protein and muscle mass[14-16,19].

Thirty-seven (74%) patients had subnormal MAMC, seventeen (34%) of whom were on regular hemodialysis. Thunberg et al reported near-normal MAMC values in dialysis patients[13]. Mitchell and Lupschitz found significantly lower MAMC values in malnourished patients, and concluded that an MAMC below 60% of standard is suggestive of decreased muscle mass[26]. Blumenkrantz *et al* found that uraemic patients with low MAMC are more wasted, debilitated, and less rehabilitated[4,12].

The concentration of serum albumin has long been used as an index of protein nutrition, even though it responds relatively slowly to changes in protein stores because of a half-life of approximately 20 days. When hypoalbuminemia occurs in non-nephrotic patients with CRF, it should be viewed as a sign of malnutrition. Studies of dialysis patients indicated that hypoalbuminemia correlates with mortality[1]. Recent recommendations used a cut-off value of 4.0 gm/dl as the lower normal limit of serum albumin instead of 3.5 gm/dl[2].

Thirty-two (64%) patients had serum albumin level less than 4.0 gm/dl, thirteen of whom were on regular dialysis and nineteen on conservative measures. This may reflect a better dietary protein intake by patients on regular dialysis. Han et al found a reduced albumin level in 30% of their patients[27].

Serum albumin level seems to be influenced not only by nutritional factors but also by non-nutritional factors such as age and the presence of acute phase protein response manifested by C-reactive protein elevation.[1,2,28-30].

Using a cut-off value of 3.5 gm/dl, only 32% of patients had low serum albumin level despite the high proportion of subnormal anthropometric measurements. This supports the idea that a cut off point of 4 Gm/dl better represents the state of patients nutrition.

Serum albumin level is still by far the most commonly used nutritional marker in patients with CRF [2,29,31].

Anemia is a common complication of CRF[1,2,6,7,32]. Ninety four percent of our dialysis patients had reduced haemoglobin level, most of them in moderate and severe categories. Others had reported lower percentages[33]. A probable cause of this difference is lack of erythropoietin therapy.

Although there are many causes other than nutritional deficiency for low hemoglobin this measurement is useful in differentiating well-nourished from malnourished patients[32].

Serum cholesterol level was reduced in 26 (52%) patients. Other investigators found similar results[12,33]. Seven (14%) patients had an elevated serum cholesterol levels (>200 mg/dl). Both reduced and high serum cholesterol levels are associated with increased morbidity and mortality. The former indicates poor nutritional status, and the latter is associated with atherosclerosis and its complications.

The high prevalence of malnutrition in the present study and other studies is due to many factors. Severe dietary restrictions (patient induced or physician induced) is the most common cause[2,7,14,15]. Other factors include late diagnosis and management[21,34,35], inadequate dialysis (noncompliance or poor tolerability), anorexia, metabolic acidosis, release of cachetic factors (e.g. TNF alfa, IL-6) and intercurrent illnesses & infections[1,2,8,22,28].

There is ample evidence that patients should initiate chronic dialysis therapy when GFR declines to a level of 10 ml/min. Patients who start therapy at lower levels of GFR are more likely to have hypoalbuminemia, greater mortality rates, and greater hospitalization rates[10,34,35].

Mean serum creatinine value in hemodialysis patients was lower than that of patients treated conservatively reflecting the fact that the latter group have remained on conservative measures too long.

Therefore nutritional status should be monitored carefully in patients with chronic renal failure and declining nutritional status should be considered a clear indication for starting regular dialysis[22,31,32].

Conclusion

1. Malnutrition is common in patients with advanced chronic renal failure treated in the university hospital.
2. Careful instructions regarding adequate dietary intake must therefore be offered for every patient with chronic renal failure, as early as possible.

3. Many patients are staying too long on conservative treatment when properly they should have been on maintenance dialysis.

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