NUTRITIONAL PROFILE AND INFLAMMATORY STATUS OF STABLE CHRONIC HEMODIALYSIS PATIENTS AT NEPHROLOGY DEPARTMENT, MILITARY HOSPITAL RAWALPINDI

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Background: Protein-energy malnutrition (PEM) is common in the haemodialysis population. Identification and management of these patients can result in significant reduction in morbidity and mortality. Aim of the study was to find the prevalence of PEM in otherwise stable haemodialysis patients at Military Hospital Rawalpindi at a single point in time with the help of established biochemical and physical markers. **Material and Methods:** Height, dry weight and body mass index (BMI) were recorded for 64, stable, 14–75 year-old patients who were on haemodialysis for ≥3 months. Blood samples were drawn (pre-dialysis) for complete blood count, serum C-reactive protein, serum total protein, serum albumin and serum Creatinine. Ideal body weights and BMI were obtained from Pakistan Army Selection and Recruitment standards. **Results:** Out of 64 patients 43 (67%) were males. Mean age was 44.5±14.3 yr. Mean haemoglobin was 8.84±2 g/dl. Fifty-seven patients (89%) had haemoglobin ≤11 g/dl. Pearson correlation coefficient (r) with albumin was significant (p=0.01). The mean serum albumin was 34.2±4.25 g/l. Serum albumin of less than 40 g/l in 58 patients (90.6%). C-Reactive protein was available for 58 (90.6%) of patients. It was positive in 23 (35.9%) and was associated with a lower mean serum albumin (32.7 g/l vs 35.4 g/l) which was statistically significant (p=0.017). There was no significant relationship between the lymphocyte count and albumin levels. However, the Pearson correlation of albumin with the total WBC count gave a p value of 0.05. Mean BMI was 19.8±2.9 kg/m^2. Thirty-seven (57.8%) patients had BMI in the normal range (18.5–24.6 kg/m^2) and 24 (37.5%) were below normal (14.6–18.3 kg/m^2). Correlation of albumin with BMI and serum creatinine was not significant (p= 0.46 and 0.53 respectively). **Conclusion:** Serum albumin is a strong marker of malnutrition but needs to be associated with other physical and inflammatory parameters to correctly identify malnourished haemodialysis patients.

Key Words: Haemodialysis; nutrition; albumin; C-reactive protein; body mass index.

INTRODUCTION

The prevalence of malnutrition in patients of end-stage renal disease on maintenance haemodialysis ranges from 10%–54%.[1,2] In this population, protein energy malnutrition (PEM) is common[3,4] and several studies have identified hypoalbuminemia as the strongest predictor of not only malnutrition but also morbidity and mortality.[5,6] Serum albumin is routinely available and is the most commonly used biochemical index having the power of predicting clinical outcomes.[7,8] However, recent literature has emphasized the negative influence of inflammation on serum albumin concentration, regardless of nutritional status.[9,10] Thus, the use of albumin does have limitations. Chronic inflammation, physical inactivity, acute or chronic conditions or illnesses and the catabolic stimulus of dialysis itself are some of the contributory factors towards malnutrition in this group.[11] Elevated C-reactive protein (CRP) level, the prototypic marker of inflammation, is frequently observed in chronic renal failure[12], and even a single determination is predictive of all cause mortality.[13] Subjective global assessment (SGA) is a reliable method for assessing nutritional status.[14] However, others have not found it sensitive enough to identify malnourished dialysis patients.[15] Anthropometric statistics are not available for the Pakistani population on the lines of National Health and Nutrition Examination Surveys (NHANES II) USA, from 1976–1980. Aim of the current study was to make prospective single point measurement of the nutritional status of stable chronic haemodialysis patients and to find association with their inflammatory state, using biochemical and physical markers.

MATERIAL AND METHODS

Study Design

This cross-sectional observational study was conducted in two parts in the months of June and July 2007 at the Department of Nephrology, Military Hospital Rawalpindi. In the first part all selected patients were evaluated for any acute or chronic infections, dry weight, height and body mass index (BMI). In the same week, before the next haemodialysis session, haemoglobin (Hb), white cell count (WBC), total lymphocytes (Lymphos), haematocrit (HCT), C-reactive protein (CRP), serum

total protein (SPro), serum albumin (Alb) and serum Creatinine (SCr) were measured.

The study was evaluated and approved by the Ethics Committee of Military Hospital Rawalpindi. The patients were informed about the study and informed consent obtained before enrolment.

Study Population

From 136 chronic haemodialysis patients treated at the dialysis centre Military Hospital Rawalpindi, 64 were selected according to the following inclusion criteria: Age 14–75 years, length of haemodialysis therapy ≥ 3 months, absence of any acute or chronic infection in the month of study or autoimmune disease, malignancy, oedema, ascites, hepatitis and not using corticosteroids. The patients were dialyzed twice weekly, 4 hr sessions using biocompatible dialyser membrane. All patients were on regular oral iron, calcium and adhering to dietary recommendations.

Anthropometric Data (Table-1)

The measurements were performed after the first haemodialysis session of the week by the same observer. Height, weight and BMI (calculated as weight in kilograms divided by square of height in meters) were recorded. Ideal body weights were obtained from the selection and recruitment standards of Pakistan Army. A BMI of 18.5–24.9 kg/m^2 was taken as normal.

Biochemical Data (Table-2)

Blood was drawn before haemodialysis session as per K-DOQI guidelines. Biochemical determinations included complete blood count (Sysmax Coulter counter Japan); serum total protein (by Biurate Reaction End-Point-Linear Spain) and serum Albumin (bromocresol green-Diamate UK). Normal range of serum Albumin >40 g/l, serum Creatinine (alkaline picrate method without deproteinization-Linear, Spain) and C-reactive protein (latex method-Linear Spain) >6 mg/l was taken as positive.

Table-1: Anthropometric data of the study population

Measurement	N	Minimum	Maximum	Mean
Height (m)	64	1.32	1.87	1.6558
Weight (kg)	64	29	82	54.61
BMI (kg/m^2)	64	14.6	28.3	19.772

BMI: Body mass index

Statistical Analysis

Continuous variables were expressed as mean±standard deviation. Correlation coefficients were calculated using the Pearson's test. Two-tailed *p* values of less than 0.05 were considered statistically significant. All tests were performed with the aid of the statistical software SPSS version 10.

Table-2: Blood counts and biochemical data of the study population

Lab Tests	N	Minimum	Maximum	Mean
Hemoglobin (g/dl)	64	5.0	16.5	8.839
Haematocrit (%)	64	16.4	48.6	27.938
Lymphocytes ×1000	64	0.5	4.4	1.548
WBC ×1000	64	1.0	18.8	6.645
C-reactive protein	58	Positive (23)	Negative (35)	…..
Serum total protein (g/dl)	64	34	91	61.69
Serum albumin (g/dl)	64	25	47	34.20
Serum creatinine (umol/L)	63	72	1410	766.76

WBC: White blood cells

RESULTS

There were 43 men and 21 women. The mean age was 44.5±14.3 yr. Fifty-five patients (86%) were prescribed erythropoeitin. Antihypertensive medications including beta-blockers, ACE inhibitors/ ARB, and calcium channel blockers were used in 44%, 25%, and 64% of patients respectively. Fourteen percent of patients were treated with HMG CoA reductase inhibitors, and 6% took aspirin. Mean Hb was 8.84±2 g/dl. Fifty-seven patients (89%), had haemoglobin ≤11 g/dl and the Pearson correlation with albumin was significant. (p=0.01). The mean serum albumin was 34.2±4.25 g/l. More than ninety percent of the sampled population had a serum albumin below 40 g/l. C-Reactive protein was available for 58 (90.6%) of patients. It was positive in 23 (35.9%) of patients and was associated with a lower mean serum albumin (32.7 g/l vs 35.4 g/l) which was statistically significant (p=0.017). There was no significant relationship between the lymphocyte count and albumin levels. However, the Pearson correlation of albumin with the total WBC count gave a p value of 0.05. Mean BMI was 19.8±2.9 kg/m^2. Thirty seven (57.8%) patients had BMI in the normal range (18.5–24.6 kg/m^2) and 24 (37.5%) were in the below normal range (14.6–18.3 kg/m^2). Correlation of albumin with BMI and serum creatinine was not significant (p=0.46 and 0.53 respectively).

DISCUSSION

The results of this analysis showed that a large number (>90%) of the studied patients had hypoalbuminemia (<40 g/l). Hypoalbuminemia occurs in a large number of patients with end-stage renal disease on chronic haemodialysis and it is highly associated with increased mortality risk in this population.[16] Positive acute-phase reactants and low

protein intake can cause a decrease in hepatic albumin synthesis,[17] and both factors have been identified as independent predictors of low serum albumin concentration.[9,18] Thus, hypoalbuminemia can be a consequence of malnutrition and/or inflammation in these patients. A similar observation was made in this study where a significant difference in the mean serum albumin levels between the positive (>6 mg/dl) and negative C-Reactive protein groups was seen. Protein-energy malnutrition cannot be attributed alone to inflammation, and factors like appetite suppression[19] and dialysis inadequacy should also be considered.[20] Apart from elevated CRP, presence of acute or chronic subacute infections should be looked for with both total WBC and lymphocyte counts as these can exert competing effects on serum albumin.[21]

In conclusion, serum albumin is a strong predictor of malnutrition in uremic haemodialysis population. BMI alone is a poor marker of PEM. However, the sensitivity can be increased by associating serum albumin with other nutritional and inflammatory markers to correctly evaluate the nutritional status of haemodialysis patients.

REFERENCES

1. Marckmann P. Nutritional status of patients on hemodialysis and peritoneal dialysis. Clin Nephrol 1988;29:75–8.
2. Cianciaruso B, Brunori G, Kopple JD, Traverso G, Panarello G, Enia *et al.* Cross-sectional comparison of malnutrition in continuous ambulatory peritoneal dialysis and hemodialysis patients. Am J Kidney Dis 1995;26:475–86.
3. Hakim RM, Levin N. Malnutrition in hemodialysis patients. Am J Kidney Dis 1993;21:125–37.
4. Mitch WE, Maroni BJ. Factors causing malnutrition in patients with chronic uremia. Am J Kidney Dis 1999;33:176–9.
5. Lowrie EG, Lew NL. Death risk in hemodialysis patients: the predictive value of commonly measured variables and an evaluation of death rate differences between facilities. Am J Kidney Dis 1990;5:458–82.
6. Owen WF, Lew NL, Liu Y, Lowrie EG, Lazarus JM. The urea reduction ratio and serum albumin concentration as predictors of mortality in patients undergoing hemodialysis. N Engl J Med 1993;329:1001–6.
7. Chertow GM, Ackert K, Lew NL, Lazarus JM, Lowrie EG. Prealbumin is as important as albumin in the nutritional assessment of hemodialysis patients. Kidney Int 2000;58:2512–7.
8. Yeun JY, Kaysen GA. Factors influencing serum albumin in dialysis patients. Am J Kidney Dis 1998;32(Suppl 4):S118–25.
9. Tapiawala S, Vohra H, Patel Z, Badve S, Shah B. Subjective global assessment of nutritional status of patients with chronic renal insufficiency and end stage renal disease on dialysis. J Assoc Physicians India 2006;54:923–6.
10. Jones CH, Wolfendem RC, Wells LM. Is subjective global assessment a reliable measure of nutritional status in hemodialysis? J Ren Nutr 2004;4(1):26–30.
11. Kaysen GA, Chertow GM, Adhikarla R, Young B, Ronco C, Levin NW. Inflammation and dietary protein intake exert competing effects on serum albumin and creatinine in hemodialysis patients. Kidney Int 2001;60:333–40.
12. Don BR, Kaysen GA. Assessment of inflammation and nutrition in patients with end-stage renal disease. J Nephrol 2000;13:249–59.
13. Kopple J. Pathophysiology of protein-energy wasting in chronic renal failure. J Nutr 1999;129(suppl):247S–51S.
14. Zimmermann J, Herrlinger S, Pruy A, Metzger T, Wanner C. Inflammation enhances cardiovascular risk and mortality in hemodialysis patients. Kidney In 1999;55:1956–60.
15. Yeun JY, Levine RA, Mantadilok V, Kaysen GA. C-reactive protein predicts all-cause and cardiovascular mortality in hemodialysis patients. Am J Kidney Dis 2000;35:469–76.
16. Lowrie EG, Lew NL. Death risk in hemodialysis patients: the predictive value of commonly measured variables and an evaluation of death rate differences between facilities. Am J Kidney Dis 1990;15:458–82.
17. Don BR, Kaysen GA. Assessment of inflammation and nutrition in patients with end-stage renal disease. J Nephrol 2000;13:249–59.
18. Kaysen GA, Stevenson FT, Depner TA. Determinants of albumin concentration in hemodialysis patients. Am J Kidney Dis 1997;29:658–68.
19. Ikizler TA, Greene JH, Wingard RL, Parker RA, Hakim RM. Spontaneous dietary protein intake during progression of chronic renal failure. J Am Soc Nephrol 1995;6:1386-91.
20. Lindsay RM, Spanner E. A hypothesis: the protein catabolic rate is dependent upon the type and amount of treatment in dialyzed uremic patients. Am J Kidney Dis 1989;13:382–9.
21. Lowrie EG. Acute-phase inflammatory process contributes to malnutrition, anemia, and possibly other abnormalities in dialysis patients. Am J Kidney Dis 1998;32(suppl 6):S105–S112.

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