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ORIGINAL ARTICLE

Association of malnutrition in peritoneal dialysis patients of Saudi Arabia

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Abstract Malnutrition is highly prevalent in dialysis patients, and a major contributor to morbidity and mortality. We have investigated the inter-relationship between malnutrition and its impact on morbidity and mortality in peritoneal dialysis (PD) patients. We enrolled 60 PD patients, and measured C-reactive protein (CRP) and various nutritional markers, including pre-albumin. Patients were classified into two groups according to the albumin level since albumin is a good marker of nutrition condition: Group I (n = 32) patients with normal albumin (NAP) where the albumin level was above or equal to 35 g/L and Group II (n = 28) patients with low albumin level (LAP) less than 35 g/L. The level (mean ± SD) of blood urea nitrogen was significantly high ($p < 0.05$) in NAP group (19.9 ± 5.76 mmol/L) compared with LAP group (15.9 ± 6.32 mmol/L). Data showed that, the mean of creatinine was significantly high ($p < 0.01$) in NAP group (921 μmol/L) compared with LAP group (584 μmol/L) (Table 2). There was a trend toward association of elevated CRP with all-cause mortality in PD patients. It is useful to incorporate albumin and CRP in the regular assessment of PD patients, whose survival may be improved by better management of malnutrition.

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1. Introduction

Malnutrition is highly prevalent among dialysis patients. The nutritional status of dialysis patients can be determined by biochemical assays, protein catabolic rate (PCR), anthropometry, and body composition methods. Over the last decade, several nutritional parameters have emerged as strong predictors of mortality in dialysis patients. Measures of visceral (serum albumin and cholesterol) and somatic protein (creatinine) stores have been well-described predictors of survival in hemodialysis (HD) and peritoneal dialysis (PD) patients

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(Avram et al., 1995; Lowrie and Lew, 1990; Avram et al., 1996; Ducloux et al., 2002; Herzig et al., 2001). Serum albumin has received increasing attention among newer indices. Due to its rapid turnover rate, short half-life, high tryptophan content, and small pool size, albumin is a highly sensitive marker of nutritional status (Mears, 1996). Chertow et al. (2000) have shown that albumin provides prognostic value in HD patients.

Kidney disease is emerging as a serious health problem in this country especially the end stage renal disease. The total number of patients with end-stage renal disease (ESRD) in the Middle East is almost 100,000, the mean prevalence being 430 per million population (pmp) (Najafi, 2009). Peritoneal dialysis is an important treatment modality for end stage renal disease (ESRD) as hemodialysis. Since peritoneal dialysis has been gaining wider usage, therefore both continuous ambulatory peritoneal dialysis (CAPD) and continuous cycling peritoneal dialysis (CCPD) have increased accordingly (Gao et al., 1999). Peritoneal dialysis is now an established therapy for patients with end stage renal failure. The technique is used by more than 100,000 renal patients in the developed world. They concluded that, it is a better procedure at preserving the residual function of the kidney than hemodialysis (Yung and Mao-Chan, 2003).

Most of the work linking malnutrition and other factors has been done in HD patients using CRP and other acute-phase proteins with serum albumin. There is a paucity of literature concerning the malnutrition of PD patients, as indicated by prealbumin and little data available in PD patients. In the present study, we evaluated the nutritional status, other factors and their impact on morbidity and mortality in PD patients of Saudi population.

2. Material and methods

2.1. Patients

Sixty patients who were diagnosed with ESRD and were on PD whether CAPD or APD for more than 4 months, doing (PET) study were selected from the peritoneal dialysis ward and peritoneal dialysis clinic at Security Force Hospital and Riyadh Al-kharj Hospital, Riyadh, KSA.

All patients were saudis, above 18 years and, free from chronic degenerative diseases such as cancer, or peritontis. Female subjects were not pregnant. Patients were classified into two groups according to the albumin level since albumin is a good marker for nutrition condition: Group I ($n = 32$) patients with normal albumin (NAP) where the albumin level was above or equal to 35 g/L and Group II ($n = 28$) patients with low albumin level (LAP) less than 35 g/L. The proforma (Questionnaire) was used for collecting the clinical characteristics of patients. Patients were followed until April 2003. General and demographic information (age, gender, diagnosis, comorbidities, and clinical and dialysis history) were collected.

2.2. Laboratory analysis

Non-fasting blood samples were collected at a routine monthly visit and a multiphasic biochemistry screen including albumin, creatinine, blood urea nitrogen (BUN), total cholesterol, prealbumin, random glucose, phosphorus, potassium, total protein, sodium, triglyceride, calcium, uric acid and CRP were performed. Albumin concentration was determined by the bromocresol green method. Prealbumin and CRP were measured by immunoturbidimetric method (Spectra East, Rockleigh, NJ, USA). CRP values less than 15 mg/L were considered normal. Serial measurements of CRP, prealbumin, albumin, creatinine, BUN, and nPCR were recorded.

2.3. Statistical analysis

This is a cross-sectional study to evaluate the nutritional status of 60 PD patients who were on CAPD and APD, for more than 4 months. Continuous variables were reported as mean ± SD. For selected comparisons between group means, parametric (*t*-test) or non-parametric (Mann–Whitney test) tests were used. Calculations were performed using SPSS for Windows 10.0.1 (SPSS Inc., Chicago, IL, USA). $P < 0.05$ was considered statistically significant.

3. Results

3.1. Demographics and patient characteristics

All participants were adults above 18 years, 33.3% above 60 years. Table 1 showed that, 25% were males and 75% were females. The causes of end stage renal failure were as follows: diabetic and hypertensive, diabetic nephropathy, hypertensive nephropathy, bilateral small kidney. The percentages of these diseases were 36.5%, 3.2%, 17.5%, 15.9%, respectively.

3.2. Laboratory data analysis

The level of albumin was considered low if it is below 35 gm/L. The results in Table 2 showed that the level (mean ± SD) of blood urea nitrogen was significantly high ($p < 0.05$) in NAP group (19.9 ± 5.76 mmol/L) compared with LAP group (15.9 ± 6.32 mmol/L). Data showed that, the mean of creatinine was significantly high ($p < 0.01$) in NAP group (921 μmol/L) compared with LAP group (584 μmol/L) (Table 2). There were no significant differences in the levels of hemoglobin, transferrin, total protein, blood uric acid, cholesterol. Data showed that the mean of random blood glucose was significantly high ($P < 0.05$) in LAP group (10.1 versus 6.9 mmol/L) compared with NAP group. The mean of creatinine clearance showed no significant differences between LAP group and NAP (Table 2).

Data showed no significant differences in mean levels of biochemical tests such as blood urea nitrogen (17.7 versus

Table 1 Sociodemgraphic findings of PD patients.

Sociodemographic parameters	Distribution	Frequency	Percentage
Sex	Male	15	25.0
	Female	45	75.0
		60	100.0
Age (years)	18–30	10	16.7
	31–45	18	30.0
	46–60	12	20.0
	Above 60	20	33.3
		60	100.0

Table 2 Biochemical parameters of patients according to the blood albumin levels.

Biochemical tests (units)	NAP	LAP	*P*
	Mean ± SD *n* = 32	Mean ± SD *n* = 28	
Blood urea nitrogen (mmol/L)	19.9 ± 5.76	15.9 ± 6.32	.01*
Creatinine (μmol/L)	921 ± 305.3	584 ± 151	0.001**
Total protein (g/L)	65.1 ± 17.6	65.2 ± 8.4	0.97
Albumin (g/L)	38.5 ± 2.6	30.2 ± 3.6	0.001**
Uric acid (μmol/L)	379 ± 69.8	349 ± 112.2	0.31
Hemoglobin (g/L)	116 ± 15.6	121 ± 17.0	0.22
Transferrin (g/L)	2.0 ± 0.25	1.59 ± 0.48	0.01*
Cholesterol (mmol/L)	4.5 ± 0.93	4.5 ± 1.09	0.91
Random blood glucose (mmol/L)	6.9 ± 3.97	10.1 ± 6.87	0.02*
Triglyceride (mmol/L)	2.4 ± 1.5	1.6 ± 1.02	0.43
Creatinine clearance (L/w)	4.5 ± 0.93	4.5 ± 1.09	0.91

* ($p < 0.05$).
** ($p < 0.01$).

Table 3 Biochemical parameters of the patients according to the type of peritoneal dialysis.

Biochemical tests	CAPD patients	APD patients	*P*
	Mean ± SD	Mean ± SD	
Blood urea nitrogen (mmol/L)	17.6 ± 6.62	19.0 ± 5.37	0.46
Creatinine (μmol/L)	799 ±93.2	654 ± 293.4	0.11
Total protein (g/L)	63.4 ± 5.2	70.0 ± 6.48	0.11
Albumin (g/L)	35.5 ± 4.86	32.33 ± 5.66	0.06
Uric acid (μmol/L)	346 ± 73.9	461 ± 86.0	0.01*
Hemoglobin (g/L)	119 ± 16.9	116 ± 14.9	0.57
Transferrin (g/L)	1.8 ± 0.33	1.7 ± 0.61	0.63
Cholesterol (mmol/L)	4.6 ± 1.01	4.2 ± 0.95	0.36
Random blood glucose (mmol/L)	8.54 ± 6.1	8.2 ± 4.5	0.83
Triglyceride (mmol/L)	2.22 ± 1.5	1.5 ± 0.67	0.53
Creatinine clearance (L/week)s	51.9 ± 11.4	55.8 ± 12.7	0.31

* ($p < 0.05$).

19.0 mmol/liter), creatinine (799 versus 654 μmol/liter), cholesterol (4.6 versus 4.2 mmol/liter), triglycerides (2.22 versus 1.5 mmol/liter) and creatinine clearance (51.9 versus 55.8 liter per week) in patients treated with CAPD compared with patients treated with APD respectively. The data showed that, the total proteins were significantly higher ($p < 0.05$) in patients treated with CAPD compared to patients treated with APD. Results indicated that sodium level was significantly higher ($p < 0.05$) in patients treated with APD compared to patients treated with CAPD. Uric acid was significantly ($p < 0.01$) low in patients treated with CAPD (346 μmol/L) compared to patients treated with APD (461 μmol/L) as illustrated in (Table 3).

4. Discussion

The present study, found that there are many indicators such as age, dietary intake, inadequate dialysis, serum albumin level, and the presence of associated diseases that affect the nutritional status of PD patients and might be the cause to malnutrition and contributing to morbidity and mortality.

The results of this study confirm the relationship between indicators of malnutrition and measures of inflammation in PD patients. The present study was carried out to evaluate the nutrition status of 60 chronic renal failures on CAPD and APD. The results showed that 46.6% of the patients were malnourished. It is well established that serum levels of nutritional markers such as albumin, creatinine, and prealbumin are decreased in malnourished dialysis patients, and that lower levels of these nutritional markers are associated with increased mortality in these patients (Avram et al., 1995; Avram et al., 1994; Avram et al., 2001; Combe et al., 2001). In the present study, we investigated the relationship of albumin to CRP levels and other nutritional markers in PD patients grouped by albumin level. 33.3% of patients were aged above 60 year with low serum albumin which was associated with malnutrition and increased rate of morbidity and mortality. There are two types of malnutrition in dialysis patients, one associated with or due to the uremic syndrome, and the other with comorbid conditions and inflammation, as suggested by Stenvinkel et al. (2000). Serum creatinine is a marker of somatic protein stores, but unlike prealbumin, serum creatinine is not a negative acute-phase protein. This relationship between CRP and creatinine implies a link between malnutrition

and inflammatory state in PD patients. In addition, in the present study 41.7% of the patients were having nausea and 25.4% were having poor appetite which are important factors for inadequate nutrition in CAPD. These results agreed with the data reported by Passadakis et al. (1999).

Serum albumin, also a negative acute-phase protein, is the most widely used nutritional marker in dialysis patients. Our data showed that 44.4% of patients have serum albumin level less than 35 g/L (Table 2). There are conflicting reports in the literature regarding the association between CRP and albumin in dialysis patients. Qureshi et al. (1998) have found an association of CRP with albumin. In addition, lower serum albumin has been reported in continuous ambulatory peritoneal dialysis (CAPD) patients with persistently elevated CRP level (Kim et al., 2002).

5. Conclusions

The assessment of the nutritional status of 60 patients under going peritoneal dialysis was performed. Morbidity is common among these patients. The most important factor for Protein-energy malnutrition (PEM) among these patients, old age, inadequate nutrient intake, high membranes transport cavity, change in smell and taste and low serum albumin, poor appetite, constipation.

In a nutshell, our study presents evidence for an inter-relationship between malnutrition and inflammation markers in PD patients. Although a negative acute-phase protein, serum prealbumin predicts nutritional status independent of inflammatory state. Regular measurement of serum prealbumin and CRP may increase the comprehensive assessment of overall status of health in PD patients. We concluded that the frequency of malnutrition is high in our population. Poor protein intake has the strongest correlation with malnutrition in PD patients. The influence of poor protein intake on nutritional status of PD patients is greater than morbidities, inflammation, and decreased energy intake. Providing, enough protein may be an effective way in preventing malnutrition in these patients. Identification and management of malnutrition should improve survival in PD patients.

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