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ASSOCIATION OF INFLAMMATION AND NUTRITIONAL STATUS IN MAINTENANCE HEMODIALYSIS PATIENTS

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ABSTRACT

Background : Malnutrition and inflammation in maintenance hemodialysis (MHD) patients are usually closely associated. Serum C-reactive protein (CRP) and Albumin are acute phase reactants, as well as sensitive and independent markers of inflammation and malnutrition.

Aims and Objectives:

1. To assess the nutritional status of MHD patients by using the Subjective Global Assessment (SGA) score and standard methods (Anthropometric measurements).
2. To find out the association of inflammation (CRP) with nutritional status.

Materials and Methods: 50 End Stage Renal Disease (ESRD) patients, aged 18 – 74 years on MHD were analyzed for serum albumin, CRP, SGA score and demographic & anthropometric data recorded. Appropriate statistical analysis was carried out.

Results : Based on SGA score, 96% of HD patients were found malnourished. SGA score had significant negative correlation ($p < 0.001$) with anthropometric measurements and a weak correlation with serum albumin. 68% of HD patients had a higher range of CRP and CRP showed a significant negative correlation ($p<0.05$) with serum albumin.

Conclusion : Inflammation likely plays a role in the development of malnutrition in hemodialysis patients. Thereby, a regular nutritional and inflammatory status check is necessary for timely detection and correction of malnutrition.

Key words : Maintenance hemodialysis, Malnutrition, Inflammation, SGA score, Albumin.

INTRODUCTION

Chronic kidney disease (CKD) is now a well recognized global threat, the prevalence of which is increasing alarmingly. The global annual growth of number of ESRD patients is reported as 7%. Maintenance dialysis is a well recognized modality of treating patients having ESRD[1]. Western and Indian studies report a high prevalence of protein energy malnutrition (PEM) in patients with CKD and ESRD on dialysis. Indian patients who traditionally consume a lower protein diet than their western counterparts may be at particularly higher risk of malnutrition.

Malnutrition and low serum albumin have been shown in the dialysis population to directly correlate with mortality[2]. In patients with CKD, as renal function decreases, dietary protein, energy intake, anthropometric parameters and biochemical markers of nutrition progressively decline. Other factors contributing to malnutrition in patients with CKD include inter current illness, altered hormonal and metabolic function and imposed restrictions on diet[3].

Malnutrition has an important clinical implication because it is well known that malnutrition is a powerful predictor of morbidity and mortality[2,6]. Hence it is necessary to assess the nutritional status of renal failure patients periodically and take measures to prevent PEM. The various methods commonly used for assessment of nutritional status are dietary recall, subjective global assessment (SGA), anthropometric measurements and serum albumin. SGA is a simple, reliable and dynamic method which provides a sound estimation of nutritional status[4,5].

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However, it has been demonstrated that patients treated with HD for long time become malnourished despite adequate dialysis dose and good protein intake, because there is an inflammation. Inflammation may itself cause anorexia and malnutrition. The simultaneous occurrence of malnutrition and inflammation results in progressive decline of serum albumin, loss of muscle mass and deterioration of anthropometric measurements.

C- reactive protein (CRP) is an acute phase protein whose synthesis in the liver is regulated by different cytokines. Serum CRP concentrations have been found to be significantly elevated in hemodialysis patients and reflects chronic inflammation in them[6,7,8].

This study was an attempt to assess the nutritional status of MHD patients by using the subjective global assessment (SGA) score, anthropometric measurements, serum albumin and also to find out the association of nutritional status with CRP as an inflammatory marker.

MATERIALS AND METHODS

This cross sectional study was conducted in the Department of Biochemistry and Nephrology, Vinayaka Mission's Kirupananda Variyar Medical College & Hospital, Salem, India. The study subjects were 50 ESRD patients (40 males/10 females), aged 18 – 74 yrs on MHD attending the nephrology unit. Hemodialysis duration was 6 to 60 months.

Subjects with acute infection, coronary vascular disease (CVD), chronic obstructive pulmonary disease, peripheral vascular disease and neoplasm were excluded from the study. The study was approved by institutional ethical committee. After obtaining informed consent from all the study subjects, venous blood samples were collected for biochemical analysis before dialysis.

Serum albumin and CRP were analysed by bromocresol green method (AGAPPE diagnostics kit) and ELISA (Diagnostics Biochem Canada) respectively.

Nutritional status of the study subjects was assessed by using one time SGA score which is calculated based on the history and physical examination as described by Destky et al[8] (Table 1). According to the SGA score, the patients are categorized as well nourished (score 1-14), mild to moderately malnourished (score 15-35) and severely malnourished (score 36-49)[2,4,9].

Nutritional status was also evaluated by using anthropometric measurements which included height, weight, body mass index (BMI), mid arm circumference (MAC) and by biochemical parameters which included measurement of serum albumin.

STATISTICAL ANALYSIS

All data analysis was carried out using the SPSS-16 software package. Results were expressed as mean and standard deviation. Association between variables was assessed using Pearson's correlation. 'p' value of <0.05 was considered as statistically significant.

RESULTS

Table 2 depicts demographic and biochemical characteristics of study subjects.

Table 3 shows nutritional status of study subjects based on SGA score. According to the SGA score, 96% of patients were found to have malnutrition (mean score: 29 ± 5.7). Of them 8% had severe malnutrition (Score: 36 - 49) and 88% had mild-moderate malnutrition (Score: 15 - 35).

Table 4 shows correlation analysis between SGA score and nutritional parameters. SGA score had a statistically significant negative correlation with BMI and MAC, whereas a weak correlation was seen with albumin which was not statistically significant.

Table 5 shows correlation analysis between nutritional parameters, albumin & SGA with CRP. Albumin was negatively correlated significantly whereas SGA was weakly correlated with CRP.

Table 1. Features of Subjective Global Assessment

S.No	Features	Score		
		1 - 2	3 - 5	6 - 7
1	Weight change	No or mild weight loss (0.5 – 1 kg)	Moderate weight loss (<5%)	Severe weight loss (>5%)
2	Change in dietary intake	No change	Borderline	Poor
3	Presence of GI symptoms	Few or no symptoms	Some symptoms for >2 weeks	Symptoms daily for >2 weeks
4	Functional state	No impairment in strength	Mild - moderate loss of strength	Severe loss of strength
5	Subcutaneous loss of fat	Little or no loss	Mild – moderate in all areas	Severe loss in some or most area s
6	Muscle wasting	Little or no loss	Mild – moderate in all areas	Severe loss in some or most areas
7	Edema	Little or no edema	Mild – moderate edema	Severe edema

Minimum score 7, Maximum score 49. [1 -14] – Well nourished, [15-35] – Mild to moderate malnourishment, [36-49] – Severe malnourishment.

Table:2. Demographic and biochemical characteristics of study subjects

Variables	Mean±SD in HD patients
No. of patients (n)	50
Sex (M/F)	39/11
Age (yrs)	50.7 ± 13.7
Dialysis duration (months)	13.67 ± 10.4
S.Albumin (gms/dl)	2.77 ± 0.35
CRP (mg/dl)	6.86 ± 5.33
BMI (kg/m^2)	20.79 ± 2.5
MAC(cm)	23.4 ±1.9
SGA Score	29 ± 5.7

Table:3. Nutritional status of study subjects based on SGA score

Percentage of patients malnourished	96%	
	Mild - Moderate Malnutrition (88%)	Severe malnutrition (8%)
Mean SGA score	28.6 ± 3.0	41.25 ± 2.21

Table:4. Correlation between nutritional parameters and SGA

Variables	r - value	p - value
BMI	-0.61	0.000**
MAC	-0.80	0.000**
Albumin	-0.009	0.9

** Correlation is significant at the 0.01 level (2-tailed).

Table:5. Correlation between nutritional parameters and CRP		
Variables	r- value	p- value
BMI	-0.05	0.7
MAC	0.17	0.23
Albumin	-0.30	0.03 *
SGA	0.16	0.2

* Correlation is significant at the 0.05 level (2-tailed).

DISCUSSION

Protein energy malnutrition and wasting are common problems among ESRD patients[1, 2]. These patients are routinely treated with hemodialysis as a form of renal replacement therapy[18]. In spite of continuous progress over the years, a 10% annual mortality rate is still reported in them[13]. Among many factors, treatment characteristics and comorbid conditions, inflammation, protein and calorie malnutrition has been shown to increase mortality in the MHD patients[10].

Malnutrition in dialysis patients has been attributed to insufficient nutrient intake due to dyspepsia, dialysis inadequacy, acidosis, hormone derangement and more recently to uremia and dialysis induced inflammation[13]. Biochemical parameters like serum albumin, anthropometry and SGA are the most common methods used to assess the nutritional status[2,5,6,7,10] , as other methods like dual-energy X-ray absorptiometry, bioelectric impedance analysis are expensive, cumbersome, rarely available, and impractical for routine use. Among these, the use of SGA score in detecting malnutrition is simple, valid, noninvasive, and easily applicable and its use correlates significantly with nutritional parameters[18].

In our study, it was observed that 48 out of 50 (96%) subjects were malnourished by the SGA method of nutritional assessment. According to anthropometric measurements, 44 were malnourished and had significant negative correlation with SGA score. There is evidence that dialysis patients have high circulating levels of inflammatory cytokines which can cause excessive protein catabolism. William E. Mitch reported that metabolic acidosis and inflammatory cytokines and resistance to anabolic hormones in HD patients, stimulates muscle protein loss leading to an alteration in anthropometric measurements[17].

SGA score had a negative correlation with serum albumin but was not statistically significant. Mean serum albumin level in the study subjects was 2.8 ± 0.4 mg/dl. 84% of our study subjects had hypoalbuminemia. Serum albumin level less than 3.5 mg/dl has been shown to be associated with increased mortality rate [11, 15].

Reduced albumin in HD patients is due to decreased nutrient intake as well as reduced synthesis in liver during an acute phase response. There is a marked increase in synthesis of positive acute phase proteins (predominantly in the liver) such as C-reactive protein (CRP), serum amyloid A (SAA), fibrinogen, and prothrombin with increased fractional catabolic rate in the presence of indwelling catheters[10, 12, 13].

In the study subjects, we found that serum CRP levels were significantly elevated in 68% of HD patients. Overall mean concentration of serum CRP was 6.83 ± 5.3 mg/dl (range 0.13 to 8.9 mg/dl) which was significantly higher than the normal range. This increase has been linked to multiple factors, including effects of hemodialysis procedure, bio incompatibility of the dialysis membrane, as well as multiple hospitalizations because of infection and/or other causes[10]. An elevated CRP has been shown to be strongly predictive of morbidity and mortality in dialysis patients[2].

We also found that serum albumin and CRP had significant negative correlation which is consistent with many other studies. Tsirpanlis et al. reported that low values of serum albumin could be attributed to inflammation, presence of malnutrition, and urinary losses, although this effect is considered to be more prominent in inflammation. Kaysen et al. demonstrated that in well dialysed patients, inflammation is the principal cause of a decrease in serum albumin. Qureshi

et al. reported that inflammation is associated with hypo albuminaemia and increased mortality in HD patients[6,7,15].

SGA score, a standard method for assessing the nutritional status in HD patients had a positive correlation with CRP which however was not statistically significant. This weak association may be due to lesser number of study subjects.

These evidences may be helpful in implementing the progress of knowledge in nephrological care in order to decrease patient mortality and morbidity.

CONCLUSION

To conclude, Malnutrition and Inflammation are the major factors for poor outcome in dialysis patients. Hence periodic assessment of these factors by using serum albumin, CRP, anthropometry and SGA score may be the best approach to improve dialysis outcome.

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