ORIGINAL RESEARCH PAPER

General Medicine

THE IMPORTANCE OF NUTRITIONAL COUNSELING FOR HYPERPHOSPHATEMIA IN MAINTENANCE HEMODIALYSIS PATIENTS

KEY WORDS: NUTRITIONAL COUNSELING, HEMODIALYSIS, HYPERPHOSPHATEMIA

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ABSTRACT

Aim: To assess the impact of dietetic intervention on the nutritional status and calcium–phosphorus metabolism in maintenance hemodialysis (MHD) patients. Material and methods: Six-month longitudinal intervention study of 162 MHD patients selected from one dialysis unit in Romania. They were divided into 4 groups according to serum albumin (SA) level and the comorbid condition of chronic liver disease (CLD). Clinical and biochemical parameters were measured at baseline and 6 months after PNC (personalized nutritional counseling). Nutritional status was assessed by mSGA (modified Subjective Global Assessment) and dietary calorie and protein intake by diet history with the help of 72 h recall method. Nutritional counselling and personalized diets were recommended by the dietician bimonthly for a period of 6 months only to groups I and III (groups with hypoalbuminemia). Results: Comparison of data collected prior PNC (T0) and 6 months after (T6) showed: phosphorus (P) level decreased significantly in all 4 groups: group I- T0 vs. T6 p=0.005, group II: T0 vs. T6 p= 0.002; group III: T0 vs. T6 p=0.001, and group IV T0 vs. T6 p=0.042; serum Ca followed a similar trend; serum parathyroid hormone (PTH) remained stationary; SA level was significantly improved in both nutrition counseling groups (group I: T0 vs. T6 p= 0.001, group III: T0 vs. T6 p=0.001, respectively). Conclusions: Our study suggests that dietetic intervention focused on phosphate and albumin control in MHD patients with hyperphosphatemia and hypoalbuminemia contributes to an improvement in important nutritional parameters and to a positive calcium-phosphorus balance.

INTRODUCTION

Chronic kidney disease (CKD) is a major public health issue worldwide. In CKD patients, malnutrition is qualitatively different from general malnutrition, which is defined as "protein-energy wasting" (PEW). Dietary therapy for the enhancement of PEW requires the aggressive intake of protein. Conversely, as protein intake and phosphorus intake correlate positively, increasing the protein intake increases the phosphorus intake, which is a poor prognostic factor in dialysis patients. One of the treatments for hyperphosphatemia in MHD patients is the restriction of phosphorus intake by dietary intervention. However, protein uptake to improve the nutritional status and protein intake restriction to correct hyperphosphatemia are contradictory treatments (1).

MATERIAL AND METHODS

This was a 6-month unicenter longitudinal intervention study that included 162 hemodynamically stable patients on hemodialysis treatment for at least 3 months recruited from BBRAUN Avitum Hemodialysis Unit, Botosani, Romania between September 2015 and March 2016. The study group was selected from 270 MHD patients based on the following exclusion criteria: age below 18 years, hospitalization or acute illness in the preceding 3 months, psychiatric disorders (like mental retardation or dementia). Participants gave informed consent before enrolling in the study. The study was approved by the Ethics Committee. All patients received a four-hour session three times a week. Patients were divided into 4 groups depending on SA level and the presence or absence of CLD (the characteristics of the study sample are summarized in first table).

Table I. Characteristics Of The Study Sample

Group I	62 MHD-CLD- patients with SA≤ 4 g/dL
Group II (control group for group I)	39 MHD-CLD- patients with SA > g/dL
Group III	43 MHD-CLD+ patients with SA≤ 4 g/dL
Group IV (control group for group III)	18 MHD-CLD+ patients with SA > 4g/dL

MHD-CLD- maintenance hemodialysis patients free of chronic liver disease; MHD-CLD+- maintenance hemodialysis patients with chronic liver disease.

Nutritional Assessment

Nutritional status was assessed by mSGA (2) which relied on seven components: weight change, dietary intake, gastrointestinal symptoms, functional capacity, comorbidity, subcutaneous fat, and signs of muscle wasting. Each component was given a score from 1 (normal) to 5 (severe). Thus, the MS (malnutrition score), sum of all components, ranged from 7 (normal) to 35 (severely malnourished). Patients were categorized into three groups: mild malnutrition (score >7), moderate malnutrition (score ≥ 21) and severe malnutrition (35). Laboratory data included SA, sCa, sP and serum PTH. In the experimental groups (I and III), patients were given repeated dietary counseling and personalized diets by a dietician, whereas control group patients (II and IV) were provided only the necessary nutritional information. The primary intention of advice was to make each patient increase their protein intake to 1.2 g/kg/day.

Diet counseling can improve nutrition in patients on MHD through recommendations for adequate protein and calorie intake and nutritional supplements as needed. Patients were counseled for dietary protein intake of 1.2 g/kg/day and energy intake to achieve body weight of 35 Kcal/kg (3). The contents of the nutritional education included a focus on individual energy and protein needs, tips to restrict the intake of potassium, phosphorus, sodium, and fluid. At the 1st session, general information of nutrition therapy and a recommended meal plan by individual requirement were given to the patients. At 2nd, 3rd and 4th session, patient's change in diet was assessed and tailored solution was suggested to achieve the adequate intake. Repeated education of nutrition therapy was done bimonthly for 6 months. Four educational materials-nutrition miniguide for HD patients, individual meal plan with food illustrations, caution food list, and cooking tips for low sodium intake. We assessed if each patient's intake was adequate based on their food habits and problems. We recorded the patient's intake and habits at every point to ensure continuous and consistent management.

Aim: To evaluate the impact of dietetic intervention on nutritional status and calcium–phosphorus metabolism in MHD patients.

Statistical analysis was made with *SPSS 18.0.* P-values ≤ 0.05

were considered statistically significant. Continuous variables are expressed as mean ± standard deviation and statistical significance of mean differences was compared using Student's T test across cohorts as appropriate. Pearson's correlation was used to assess the relationship between mineral markers, SA and mSGA.

RESULTS

Patient's mean age was 56,32 ± 13,45 years and mean HD time was 64.78 47.72 months. Mean SA and P were 3.92±0.33 mg/dL and 8,79±0,76 mg/dL, respectively (tab. II). On study groups at baseline, there were no significant differences in mean sCa, sP, and serum PTH levels, neither between group I and group II (8.69 *vs.*. 9.08 mg/dL, p = 0.056; 5.09 *vs.* 5.32 mg/dL, p = 0.448; 646.11±925.73 *vs.* 639.38±823.91, p=0,970 respectively), nor between groups III and IV (8.61 *vs.* 8.92 mg/dL, p = 0.182; 5.54 *vs.* 5.33 mg/dL, p = 0.615; 637.21±667.58 *vs.* 493.72±240.02, p= 0,038) respectively) (tab. II). Both SA and mSGA showed significantly higher levels in the control groups (II and IV). sP demonstrated significant direct and moderate correlations with SA in groups I, II, and IV (tab. III). On the other hand, the only plausible indirect correlation of strong intensity (r = -0.725; p = 0.001) between sP and mSGA was found in group IV (control group) suggesting the following formula: the higher the sP, the lower the malnutrition score. Regarding sCa and PTH, the correlations were null with both SA and mSGA malnutrition score in all groups analyzed (tab. III).

Table II. Comparison Of The Descriptive Indicators Of Serum Calcium, Phosphorous And PTH Between Study Groups

LAB. DATA	GROUP I	GROUP II	GROUP III	GROUP IV	Total
	n= 62	n=39	n=43	n=18	n=162
sCa	8.69±0.66	9.08±0.74	8.61±0.86	8.92±0.76	8.79±0.76
t test	p=0.056 $_{I\ vs.\ II}$		p=0.182 $_{III\ vs.\ IV}$		
sP	5.09±1.65	5.32±1.21	5.54±1.50	5.33±1.59	5.2±1.50
t test	0.448 $_{I\ vs.\ II}$		0.615 $_{III\ vs.\ IV}$		
sPTH	646.11±925.73	639.38±823.91	637.21±667.58	493.72±240.02	625.20±780.67
t test	0.970 $_{I\ vs.\ II}$		0.038 $_{III\ vs.\ IV}$		
SA	3.72±-.23	4.24±0.20	3.79±0.29	4.24±0.11	3.92±0.33
t test	0.001 $_{I\ vs.\ II}$		0.001 $_{III\ vs.\ IV}$		
mSGA	18.40±5.95	11.44±2.87	17.02±5.67	11.94±3.61	15.64±5.86
t test	0.001 $_{I\ vs.\ II}$		0.001 $_{III\ vs.\ IV}$		

n- number of subjects; sCa-serum calcium; sP- serum phosphorus; sPTH- serum parathyroid hormone; SA- serum albumin; mSGA- modified Subjective Global Assessment;

Table III. Correlations Between sCa, sP, And sPTH And SA And mSGA (Malnutrition score)

LAB. DATA	GROUP I n= 62		GROUP II n=39		GROUP III n=43		GROUP IV n=18	
	SA	mSGA	SA	mSGA	SA	mSGA	SA	mSGA
sCa	r=+0.03 p= 0.997	r=-0.025 p= 0.85	r=+0.162 p= 0.325	r=+0.157 p= 0.341	r=-0.031 p=0.841	r=+0.167p =0.285	r=+0.046p =0.856	r=-0.283 p=0.256
sP	r=+0.033 p= 0.102	r=-0.264 p= 0.038	r=+0.106 p=0.102	r=+0.407p= 0.027	r=-0.381 p= 0.012	r=+0.066p =0.674)	r=+0.639p =0.004	r=-0.725 p=0.001
sPTH	r=-0.092 p= 0.479	r=+0.190 p= 0.140	r=+0.033 p= 0.840	r=+0.265p= 0.103	r=-0.055 p=0.726	r=-0.017 p=0.915	r=+0.148p =0.559	r=+0.229p =0,360

n- number of subjects; sCa-serum calcium; serum sP- phosphorus; sPTH- serum parathyroid hormone; SA- serum albumin; mSGA- modified Subjective Global Assessment;

After the 6 PNC months, the laboratory data showed (tab. IV): the mean serum calcium level decreased significantly compared to baseline only in group II; sP decreased significantly in all study groups; mean serum PTH level remained linear in all groups except group IV (control group) in which it had an upward trend. Mean SA level had significantly improved at the end of the study only in the nutritional counseling groups (I and III).

Table IV. Comparative Evolution Of Mean sCa, sP, sPTH And SA Levels Compared By Study Groups

LAB. DATA	GROUP I		GROUP II		GROUP III		GROUP IV	
	T0	T6	T0	T6	T0	T6	T0	T6
sCa	8.69± 0.66	8.64± 0.78	9.08± 0.74	9.08± 0.74	8.61± 0.79	8.51± 0.79	8.92± 0.76	8.73± 0.67
t test	p=0.587		p=0.037		p=0.380		p=0.138	
sP	5.09± 1.65	4.46± 1.18	5.32± 1.21	4.62± 1.29	5.56± 1.51	4.70± 1.18	5.33± 1.59	4.77± 1.09
t test	p=0.005		p=0.002		p=0.001		p=0.042	
sPTH	646.11 ± 117.57	626.31± 91.89	639.38 ± 131.93	643.11± 103.15	630.39± 104.02	640.56 ± 101.75	493.72 ± 56.57	623.55 ± 90.93
t test	p=0.730		p=0.962		p=0.882		p=0.040	
SA	3.72± 0.23	4.08± 0.28	4.24± 0.20	4.28± 0.24	3.79± 0.29	4.00± 0.23	4.24± 0.11	4.21± 0.22
t test	p=0.001		p=0.245		p=0.001		p=0.589	
mSGA	18.40	29.45	11.44	11.44	17.02	15.12	11.94	12.22
t test	0.001		1.000		0.001		0.439	

sCa-serum calcium; sP- serum phosphorus; sPTH- serum parathyroid hormone; SA- serum albumin; mSGA- modified Subjective Global Assessment.

DISCUSSION

After intensive 6-month nutritional counseling and encouraging patients to follow personalized diets based on their biochemical and hormonal balance, an improvement in biological nutritional markers and mineral balance was observed. The intake of dairy products containing animal protein and highly rich in P, a main source for supporting muscle mass and nutritional status in this category of patients was reduced quantitatively, the consequence being a decrease in serum Ca and P. However, meat preparations were on the list of foods allowed with the intention of minimizing the animal protein deprivation from dairy products and consequently to support and maintain the declining predialysis muscle mass. As a result, we obtained a statistically significant improvement of SA and mSGA in parallel with a statistically significant decrease of sP, together/with phosphate binder treatment. Vijaya *et al.* (3) reported similar results: a significant reduction in mSGA scores reflecting an improvement in nutritional status of patients who received counseling by the renal dietician. On the other hand, the recent study by Inoue *et al.* (1) concluded that normalization of serum phosphorus level by protein intake restriction prevented secondary hyperparathyroidism and vascular calcification in MHD patients, but, conversely, protein intake restriction came almost mandatory with malnutrition risk. In 2017, another longitudinal study aimed at evaluating the impact of personalized nutritional counselling on the nutritional status of MHD patients (4). This study suggested that consecutive PNCs contributed to the improvement of the protein intake, serum albumin levels, and cholesterol, and to a delayed onset of muscle wasting (calculated by bioimpedance analysis), which could also have a positive impact on the nutritional status, particularly in malnourished patients receiving HD treatment. Also, the multicenter longitudinal intervention study of Garagarza *et al.*

(5), with 6 months of follow-up and 731 MHD patients from 34 dialysis units, concluded that dietetic intervention contributed to the improvement of important nutritional parameters in these population. It must be noted that these results were concurrent with improvements in the biochemical indicators. As serum albumin level is an index that is closely related to the nutritional status and to mortality when excluding inflammation (6), the results of this study suggest an improvement in the nutritional status and clinical outcome. Due to the continuous protein loss from dialysis, HD patients are easily exposed to body mass wasting in the absence of sufficient protein intake (7).

This more careful tactic on expanding and enriching the specific nutritional knowledge is not only related to the medical staff but is largely related to the patient's ability to understand and also to his / her financial status and ambition to change the eating habits and practically the lifestyle. The perseverance of the nutritionist and also of the psychologist is essential in this context. Assessment of nutritional status, use of tests for the measurement of appetite, satiety, desire to eat, but also of clinical-biological nutritional parameters, become mandatory both at the initiation of dialysis therapy and regularly every 3-6 months after dialysis initiation (8).

The nutritional counseling plan requires a quarterly up-date, and in the patients who developed moderate-severe malnutrition to be ready for artificial feeding initiation.

CONCLUSIONS

Our study suggests that dietetic intervention focused on phosphate and albumin control in hemodialysis patients with hyperphosphatemia and hypoalbuminemia contributes to an improvement in important nutritional parameters and to a positive calcium-phosphorus balance in patients receiving hemodialysis treatment. Thus, the positive effect of the nutritional education and dietary counseling in patients with renal disease plays a significant role in the preservation of nutritional status and overall well-being of these patients.

However, such an intensive monitoring may not be possible, since it needs a large number of dieticians to meet the greater demand of patients.

CONFLICT OF INTEREST AND FUNDING

The authors declare that there is no conflict of interest, and they received no specific funding regarding this scientific research.

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