

Plasma proteins in malnourished hemodialysis patients on protein supplemented diet

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Οι πρωτεΐνες του πλάσματος σε υποθρεπτικούς αιμοκαθαιρόμενους ασθενείς που ελάμβαναν πρωτεϊνούχο διαιτητικό συμπλήρωμα

Περλήψη στο τέλος του άρθρου

Key words: Chronic renal failure, Hemodialysis, Malnutrition, Plasma proteins, Supplementation

Malnutrition is a common complication of chronic renal failure (CRF), especially in patients on hemodialysis (HD) therapy. It affects a high percentage of the hemodialysis population and is closely related to increased morbidity and mortality.¹ Biochemical investigations are widely used in assessment of the nutritional status in order to diagnose protein-energy malnutrition (PEM).²⁻⁴ Changes in the concentrations of various plasma proteins correlate with visceral protein synthesis and affect the nutritional status. Sensitive markers for the diagnosis of PEM are the serum proteins albumin, prealbumin, total protein (TP) and transferrin.

Protein-energy supplementation of the usual diet is a method often used to treat dialysis related malnutrition. Oral supplements are comparatively inexpensive and yet can be effective. The changes in serum protein levels can be considered as predictors of the effect of the therapy of malnutrition.

The aim of this investigation was to ascertain the changes in several plasma proteins, albumin, prealbumin,

TP and transferrin, as indicators of PEM in malnourished HD patients treated with the oral protein supplement "Nutridial".

MATERIAL AND METHOD

The study included 28 patients (16F, 12M), mean age 43.6 years (range 24 to 67 years) and mean duration of dialysis treatment 105.8 months (range 5 to 207 months), with signs of PEM but without clinical symptoms of intercurrent illness. Selection criteria for inclusion in the study were: low levels of albumin and TP, low predialysis levels of urea and creatinine, and a tendency for weight loss. The primary renal diseases of the patients were: chronic glomerulonephritis in 10 cases, chronic pyelonephritis in 9 cases, polycystic kidney disease in 3 cases and systemic lupus erythematosus nephropathy in one case. The HD treatment schedule was as follows: thrice weekly dialysis sessions of 12–13.5 hours, acetate bath, polysulphone and cellulose-acetate membranes.

The protein supplement in powder form "Nutridial" (tabl. 1), which was developed using mathematical modelling of the aminoacid content, was ingested at an average of 0.3 g protein/kg BW/day. The quantity of the supplement given individually to the patients was calculated as the difference between the protein intake proposed for hemodialysis (1.2 g/kg BW/day) and the real intake established in this group by seven-day dietetic diaries (0.93 g/kg BW/day).

Blood for testing was drawn from the arteriovenous fistula via the needles inserted at monitored the start of the dialysis procedure. The parameters, albumin, TP, prealbumin and transferrin, were measured at the start and at 3 and 6 months by autoanalyzers Hitachi 704, RA-500 and radial immunodiffusion.

All values were expressed as mean plus/minus standard deviation.

Table 1. Chemical and aminoacid content of "Nutridial".

Chemical content (g/100 g product)	Aminoacid content (g/100 g protein)	
Protein-58-60	VAL-5.4	LEU-8.6
Carbohydrates-30-35	ILE-4.8	TRP-1.1
Fats 5-9	TYR-4.1	ARG-5.8
Minerals-4.4	MET-1.8	PHE-5.0
Fibers-0.10	LYS-6.8	HIS-2.5
Water-4	CYS-1.1	THR-3.8
Energy content of 100 g product=274 kcal	ALA-3.9	ASP-9.8
	GLY-3.2	GLN-20.5

RESULTS AND DISCUSSION

The levels of the plasma proteins over the course of the investigation are shown in table 2.

Albumin level is the parameter most often used when assessment of nutritional status is made, since it shows significant correlation with other important parameters such as creatinine, prealbumin, triceps skinfold thickness (TST), arm-muscle circumference (AMC). The levels of albumin in the course of supplementation showed an increase which was most pronounced at the third month (38.04 ± 4.40 g/L vs 35.52 ± 3.67 , $P < 0.05$), but one month after discontinuation of "Nutridial" their values (35.92 ± 3.66 g/L) returned to close to the baseline level which suggests that the improvement of the albumin status was related to protein supplementation.

Changes were similar to those observed for albumin were registered for TP. From 66.96 ± 4.26 it was elevated to 71.08 ± 6.02 g/L, $P < 0.05$, at the third month. Insignificant decline was demonstrated at the sixth month (69.33 ± 2.85 g/L). Even one month after the end of the supplementation, it remained higher (67.37 ± 4.58 g/L) compared to the starting point. Although TP is not considered a very reliable or sensitive parameter in the diagnosis of malnutrition, its fluctuations exhibit the same pattern as albumin and confirm the positive role of the optimized protein intake.

The levels of transferrin are highly influenced by the iron content in the organism, which in patients with CRF on dialysis treatment may be either increased from numerous blood transfusions or decreased due to insufficient food intake or recombinant human erythropoietin treatment without adequate iron supplementation, which lowers its diagnostic value.^{2,5} In this investigation the iron status of the patients was not ascertained. The transferrin levels showed steady although insignificant elevation from 2.63 ± 0.39 g/L to 2.70 ± 0.58 g/L at the sixth month.

Table 2. Parameters of protein nutritional status of the 28 patients in the course of the investigation.

Parameter	Base level (mean \pm SD)	3 months (mean \pm SD)	6 months (mean \pm SD)
Alb g/L	35.52 ± 3.67	38.04 ± 4.40	37.76 ± 2.20
TP g/L	66.96 ± 4.26	71.08 ± 6.02	69.33 ± 2.85
Plealbumin g/L	3.28 ± 0.87	3.33 ± 1.57	3.58 ± 0.97
Transferrin g/L	0.263 ± 0.039	0.267 ± 0.041	0.270 ± 0.058

The level of prealbumin due to its short half life changes quickly when the protein dietary intake is increased. This allows its application in assessment of whether treatment of malnutrition is effective independent of the level.^{6,7} In this study the positive effect of protein supplementation with "Nutridial" on other nutritional parameters also affected prealbumin which rose from a base level of 0.328 ± 0.087 g/L through 0.333 ± 0.157 at the 3rd month to 0.358 ± 0.097 at the 6th month. The tendency for increase continued after the end of the supplementation (7th month), independent of the fact that the half life of this protein is shorter than the period between the last two measurements. These results correspond with other published data. According to Miller and coauthors, serum prealbumin levels in patients with CRF, independent of their nutritional status, are normal or elevated due to diminished renal excretion.⁸ Cano found that prealbumin is the most predictive indicator of the effect of the therapy, since it correlates closely with five other nutritional parameters (body weight, albumin, creatinine, TST, AMC) and three complications: infections, the presence of HBsAg and mortality.⁹ Ikizler and co-workers consider that albumin, prealbumin and transferrin levels in HD patients are highly influenced by inflammation.¹⁰

The data for the plasma proteins studied correlates with other investigations by the authors on the plasma amino acid spectrum in similar groups of malnourished HD patients on a diet supplemented with "Nutridial".^{11,12}

It can be concluded that the plasma proteins studied, albumin, TP, prealbumin and transferrin, can be used as markers of malnutrition in patients with CRF on HD treatment and in assessment of the effect of protein supplementation. The newly developed protein product "Nutridial" can be recommended for protein supplementation in such groups of patients.

ΠΕΡΙΛΗΨΗ

Οι πρωτεΐνες του πλάσματος σε υποθρεπτικούς αιμοκαθαριζόμενους ασθενείς που ελάμβαναν πρωτεϊνούχο διαιτητικό συμπλήρωμα

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Σκοπός της μελέτης ήταν η διερεύνηση των μεταβολών των πρωτεϊνών του πλάσματος, λευκωματίνη, προλευκω-

ματίνη, ολικές πρωτεΐνες (ΟΠ) και τρανσφερίνη, ως δεικτών της ενεργειακής-πρωτεϊνικής υποθρεψίας (ΕΠΥ), σε υποθρεπτικούς αιμοκαθαρόμενους ασθενείς, στους οποίους χορηγείτο πρωτεϊνούχο διαιτητικό συμπλήρωμα από του στόματος (Nutridial). Στη μελέτη περιελήφθησαν 28 ασθενείς με συμπτωματολογία ΕΠΥ, οι οποίοι πληρούσαν τα ακόλουθα κριτήρια: χαμηλά επίπεδα λευκωματίνης, προλευκωματίνης και ΟΠ αίματος, χαμηλά επίπεδα ουρίας και κρεατινίνης πριν από την αιμοκάθαρση και τάση για απώλεια βάρους. Οι υπό μελέτη παράμετροι προσδιορίστηκαν πριν και μετά από 3 και 6 μήνες χορήγησης του διαιτητικού συμπληρώματος, με τη χρήση αναλυτή Hitachi 704, RA-500 και ακτινωτής ανοσοδιάχυσης. Τα επίπεδα της λευκωματίνης παρουσίασαν αύξηση κατά τη διάρκεια χορήγησης του διαιτητικού συμπληρώματος, η οποία ήταν περισσότερο εξεσημασμένη κατά τον τρίτο μήνα, και υποχώρησαν περίπου στα προ της χορήγησης επίπεδα ένα μήνα μετά από τη διακοπή της. Τα επίπεδα των ΟΠ παρουσίασαν τις ίδιες μεταβολές με τη λευκωματίνη, επιβεβαιώνοντας τη θετική επίδραση της χορήγησης πρωτεϊνών. Τα επίπεδα της τρανσφερίνης παρουσίασαν μη σημαντική αύξηση, ενώ η θετική δράση της χορήγησης πρωτεϊνών στις υπόλοιπες διαιτητικές παραμέτρους επηρέασε και την προλευκωματίνη. Τα αποτελέσματα της μελέτης υποδηλώνουν ότι οι πρωτεΐνες που μελετήθηκαν, μπορούν να χρησιμοποιηθούν ως δείκτες της υποθρεψίας και της επίδρασης της χορήγησης πρωτεϊνούχων διαιτητικών συμπληρωμάτων, σε ασθενείς με χρόνια νεφρική ανεπάρκεια υπό αιμοκάθαρση. Επιπλέον, επιβεβαιώθηκε η θετική επίδραση του διαιτητικού συμπληρώματος που χρησιμοποιήθηκε στη συγκεκριμένη μελέτη.

Λέξεις ευρετηρίου: Αιμοκάθαρση, Πρωτεΐνες πλάσματος, Πρωτεϊνούχο διαιτητικό συμπλήρωμα, Χρόνια νεφρική ανεπάρκεια

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