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Research paper

Malnutrition in elderly patients with renal failure: Importance of pre-dialysis period

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ABSTRACT

Background and aims: In elderly, renal failure is one of the major comorbidities. Malnutrition is another clinical problem in these patients' follow-up. In this study, we compared nutritional states of elderly patients with different renal functions.

Methods: Eighty-three predialysis and 121 hemodialysis (HD) patients of 65 years and older and as control group, 46 elderly patients with no renal failure were compared. Blood urea nitrogen, creatinine, thyroid stimulating hormone, vitamin B12 and folic acid levels were measured in every patient. Nutritional status of all patients was evaluated with Mini Nutritional Assessment Short Form (MNA-SF). One-way ANOVA, post-hoc Tukey and Pearson correlation analysis were used for statistics.

Results: The mean MNA-SF of pre-dialysis patients was 8.67 ± 3.00. In HD patients, it was 11.44 ± 2.43 and in control, it was 11.48 ± 2.27. In HD patients, a weak correlation was detected between higher BUN, creatinine and higher MNA-SF ($r = 0.181$, $P = 0.047$), ($r = 0.181$, $P = 0.046$). In HD patients, vitamin B12 levels were higher than pre-dialysis and control group ($P < 0.001$).

Conclusion: In elderly patients with renal failure, malnutrition starts in pre-dialysis period and MNA-SF can be a reliable technic for these patients' nutritional evaluation.

1. Introduction

Chronic kidney disease (CKD) is one of the most serious morbidities in the elderly population [1].

Also, 31% of the elderly patients with creatinine clearance below 60 mL/min are malnourished [2]. Malnutrition is an independent predictor for morbidity and mortality for these patients [3,4].

Association between renal failure and malnutrition is multifactorial. Age, education, and poverty are invariable predisposing factors. The main biological mechanisms that renal failure contributes to development of malnutrition are depressed appetite, restricted diet, increased dialysis-related loss of nutrients, inflammatory, hormonal and metabolic disturbances [5,6]. Clinical signs of malnutrition are indicators for patients' general state deterioration and dialysis sometimes should soon be started [7]. Despite all modalities, death from cachexia is not rare in elderly patients on dialysis.

Periodical nutritional assessments should be part of routine monitoring for these patients. For this purpose, many methods are commonly used. Appetite, food and protein consumption records, body weight, biochemical parameters, anthropometric measurements, and nutritional indexes are some of them. Multidimensional approach should be used and currently non-invasive assessments methods are greatly desired for routine monitoring. Between indexes the Mini Nutritional Assessment (MNA) and its short form (MNA-SF), is one of the reliable methods used in elderly patients for this purpose [8].

In this study, we compared the nutritional state in three groups of elderly; patients on hemodialysis (HD), pre-dialysis patients and those with no renal dysfunction.

2. Material and methods

2.1. Study design and participants

This prospective study was conducted in Bezmialem Vakif, Dokuz Eylul Universities and the dialysis units of Turkish Kidney

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Foundation. All patients admitted to nephrology and geriatrics clinics were screened for inclusion. Fifty-eight pre-dialysis patients and 121 HD patients of 65 years and older and for control 48 elderly patients with no renal dysfunction were included in the study. Patients' glomerular filtration rate (GFR) was calculated using modification of diet in renal disease (MDRD) formulation. HD patients were receiving conventional 4 hours HD, three times weekly for more than 3 months with bicarbonate dialysate at a flow rate of 500 mL/min and heparin as standard anticoagulation using low flux (ultrafiltration rate < 20 mL/mmHg/h) polysulfone membrane dialyzers F6 and F8 (Fresenius, Bad Homburg, Germany) with a blood flow rate of 300 mL/min. For pre-dialysis group, patients with GFR below 60 mL/min/1.73m^2 were included. Exclusion criteria for all groups were the presence of active neoplasm, hypothyroidism with no treatment, nephrotic syndrome, hepatic failure, malabsorption syndromes, severe heart failure, inflammatory bowel disease, nutrition and swallowing problems and enteral or parenteral nutrition support. In HD patients, < Kt/V of 1.4 was another exclusion criteria.

Before participation written approval was taken from the patient or the patients' relatives. The study protocol was in accordance with Declaration of Helsinki and was approved by the Institutional Local Ethic Committee (No: B.30.2.BAV.0.05.05/253).

2.2. Procedure and data collection

All patients' nutritional state was evaluated with MNA-SF by the same investigators. Pre-dialysis and control groups were evaluated at the geriatric outpatient clinic. HD patients were tested during the midweek HD session. For MNA-SF, patients' food intake over the past 3 months, weight loss during the last 3 months, mobility status, presence of psychological stress or acute disease in the past 3 months, neuropsychological problems and body mass index (BMI) were recorded. BMI were calculated as the weight in kilograms divided by the square of the height in meters.

According to MNA-SF scores, patients were classified as malnourished if their score was between 0 and 7. They had a risk of malnutrition if their score was between 8 and 11 and they were normal if the scores were between 12 and 14 [8].

Blood samples were evaluated after a 12 hour fasting in the outpatient setting for pre-dialysis patients and healthy elderly and at the beginning of the midweek session for HD patients. Blood analysis was performed at the central laboratory. BUN, creatinine, thyroid stimulating hormone (TSH), vitamin B12 and folic acid levels were tested with Roche Diagnostics GmbH kits in Roche Hitachi Cobas 8000 device.

2.3. Statistical analysis

Statistical analysis was performed with using SPSS software version 19.0. For independent evaluation, one-way ANOVA analysis was used. For the correlation between MNA-SF and other parameters Pearson correlation test was used. Post-hoc Tukey analysis was used for inter-group analysis for each parameter. P less than < 0.05 was accepted as significant.

3. Results

All patients' base-line demographic features were similar. The mean dialysis duration of HD patients was 6.24 ± 4.67 years.

Between all groups, significant statistical difference was observed in terms of creatinine levels ($P < 0.001$). The means of biochemical and nutritional parameters and correlations between groups are presented in Table 1. In HD patients, very weak correlation was detected between higher BUN and creatinine and higher MNA-SF ($r = 0.181$, $P = 0.047$), ($r = 0.181$, $P = 0.046$). But in pre-dialysis patients and control group, there was no relationship between BUN, creatinine and MNA-SF ($r = 0.314$, $P = 0.005$), ($r = 0.216$, $P = 0.052$), ($r = 0.040$, $P = 0.814$), ($r = 0.244$, $P = 0.103$).

In pre-dialysis patients, statistical lower MNA-SF was observed. Along with MNA-SF analysis, there was statistical difference between control group and pre-dialysis patients and also pre-dialysis and HD patients ($P < 0.001$). But any difference was not observed between control and HD patients ($P = 0.996$) (Fig. 1).

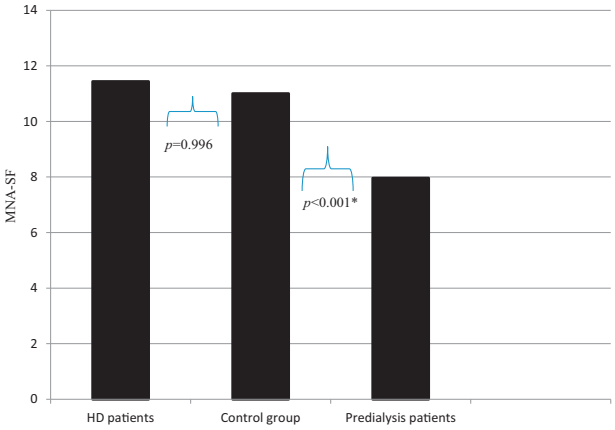

Fig. 1. Differences between patient groups according to MNA-SF. *P between HD with pre-dialysis and control with pre-dialysis.

Table 1
The patients' baseline clinical features and correlations between biochemical parameters and nutritional scores of the groups.

	Patients' groups				
	HD patients	Pre-dialysis patients	Control group	P value[a]	P value[b]
Age (years)	73.18 ± 6.11	76.80 ± 7.87	75.80 ± 5.57	0.01–0.698	0.062
n	121	83	46		
Sex (♀/♂)	53/68	46/37	26/20		
BUN – mg/dL	59.93 ± 16.43	65.18 ± 45.44	17.82 ± 5.02	0.420– < 0.001	< 0.001
Creatinine – mg/dL	7.05 ± 1.62	2.74 ± 1.71	0.83 ± 0.22	< 0.001– < 0.001	< 0.001
Vitamin B12 – pg/mL	1452.6 ± 637.45	822.11 ± 772.44	374.40 ± 281.98	< 0.001–0.001	< 0.001
Folic acid – ng/mL	8.91 ± 5.34	8.61 ± 5.35	7.67 ± 3.15	0.716–0.978	0.849
TSH – mIU/mL	3.76 ± 5.56	2.34 ± 5.69	2.00 ± 1.52	0.221–0.903	0.062
MDRD	7.88 ± 3.02	29.31 ± 15.84	84.41 ± 18.82	< 0.001– < 0.001	< 0.001
MNA-SF (av)	11.44 ± 2.43	8.67 ± 3.00	11.48 ± 2.27	< 0.001– < 0.001	0.996
Normal (MNA > 11)	70(57.8%)	18(21.6%)	28(60.8%)		
Risk of malnutrition (7 < MNA ≤ 11)	41(33.8%)	37(44.5%)	16(34.7%)		
Malnourished (MNA ≤ 7)	10(8.26%)	28(33.7%)	2(4.3%)		

MDRD: modification of diet in renal disease; MNA-SF: Mini Nutritional Assessment Short Form.
[a] P between HD with pre-dialysis and control with pre-dialysis.
[b] P between HD and control group.

There was no relationship between MNA-SF scores and dialysis duration ($r = 0.005$, $P = 0.961$).

4. Discussion

In this study, only nutritional state of pre-dialysis patients was more defective than other groups. Elderly HD patients were in a better state than expected. In this cross-sectional design study, to avoid interference of other factors such as insufficient dialysis or comorbidities strict inclusion and exclusion criteria was used.

In elderly and in patients with CKD, malnutrition is one of the major clinical problems and nutritional follow-up should be an indispensable component of their management. Many factors effect nutritional state in elderly. Polypharmacy, cognitive and functional dysfunction and dementia are some of them. This problem is finally associated with immune dysfunction, anemia, decreased bone mass, poor functional status, increased hospitalization, sepsis and mortality [9,10]. In patients with CKD, uremia and dialysis related factors are responsible for malnutrition. Also, in HD period additional problems occur such as; increased carboprotein requirement, cardiac output, energy consumption and loss of nutrients during dialysis [11]. Despite these multiple dialysis related factors, in our study pre-dialysis patients' nutritional state was more deficient than HD patients. Severe dietary protein restrictions and insufficient follow-up in terms of nutrition can be responsible from this result.

A high quality pre-dialysis care requires further investigations. In uremia, changes in catabolic cytokines (IL-1beta, IL-6, tumor necrosis factor-alpha [TNF-alpha]) and anabolic growth factors (insulin-like growth factor-I [IGF-I]) are observed. In pre-dialysis, decreased serum IGF-I and increased TNF-alpha levels were detected and these results were associated with malnutrition pathogenesis in CKD patients [12]. Also, increase in other catabolic hormones -parathyroid hormone, glucagon, corticosteroids and angiotensin II- and deficiency or resistance to anabolic hormones like insulin, growth hormone, testosterone and 25(OH) D3 were observed CKD and elderly patients [13]. Unfortunately, possible relationship along with these parameters was not evaluated for our patients.

In elderly CKD patients with malnutrition, cognitive dysfunction, depression, serious courses of diseases, impaired physical activities, increased cardiovascular risk, bone loss and fractures, peripheral vascular diseases, ischemic ulcers and finally poor quality of life and decreased survival are a number of clinical results [14]. Early diagnostic procedures and therapeutic interventions are mandatory.

For evaluation of nutritional status, biochemical, anthropometric parameters, and nutrition tests are used. Slight reductions of albumin, prealbumin and ferritin were statistically associated with increased mortality but with these markers, a reliable evaluation is not possible in terms of nutrition [15]. Pre-dialysis hypopotassemia, hypophosphatemia and hypocholesterolemia are other indicators of malnutrition. But proper evaluation only with these biomarkers is not sufficient. In our study, pre-dialysis patients' plasma albumin levels were lower according to other groups. But statistical difference could not be demonstrated. In terms of Vitamin B12, HD patients and then pre-dialysis group has better levels than control. Probably these groups' routine hospital monitoring has been effective from this result.

Nutrition tests are another tool for this evaluation and many indexes were developed in last years. Especially in HD patients Geriatric Nutritional Risk Index (GNRI) was observed as an accurate risk index and has been presented as mortality predictor [16,17]. As another technic, Malnutrition Inflammation Score (MIS) is a sensitive method for HD patients along with not especially for elderly [18]. In pre-dialysis period, another method Subjective Global Assessment (SGA) was evaluated for this purpose along with similar to our patients' group and presented as useful assessment method for pre-dialysis patients [19].

MNA-SF is another useful method. Proven sensitivity was observed in different patients' groups. In community-dwelling elderly adults, it was compared with different tools and presented an appropriate method for these patients [20]. In this group of patients, physical dependency and chronic morbidities were associated with malnutrition risk determined by MNA-SF [21]. But in a longitudinal, prospective study, MNA-SF was not evaluated as a mortality predictor and override effect of severe comorbidities and acute diseases were predicted from this result [22]. There are a few studies that evaluate predictivity of MNA-SF in patients with CKD. This form predictive validity was presented effective in HD patients especially excluding BMI [23]. But recent years, although MNA-SF has major key items, full MNA was evaluated more effective especially in HD patients. These patients' appetite, medication and fluid intake problems and less satisfaction for their health has been implicated from this result [24]. Another version, MNA-Taiwan 1 (MNA-T1) was evaluated along with SGA, and MNA-SF in HD patients. In that study, neuropsychological problems were exchanged with self-view of nutritional status and self-view of health status parameters. For this population, this pattern was presented appropriate in HD patients [25]. In our study, majority of HD patients were normal or at risk of malnutrition. If an assessment could be used with exchanged parameters similar that studies, for patients at risk scale, may be detected in malnutrition.

In pre-dialysis, nutritional state was evaluated in different perspectives in literature. Two different approaches were observed. Although, in attempts to slow down progression, low protein diets and finally earlier dialysis was recommended, because of HD catabolic process and high mortality rate in dialysis patients. But others proposed delayed dialysis initiation until uremic symptomatology [26,27]. In observational studies, especially in elderly, early HD treatment before malnutrition development was proposed [28,29]. In this period, low protein intake is another precipitating factor on development of malnutrition [30]. For this group of patients, protein intake should be regulated as 1 to 1.3gr/kg/day [31]. Along with these suggestions, there is no any diagnostic method with proven sensitivity for patients in this period. In our study, nutritional state that determined with MNA-SF was significantly deficient in pre-dialysis patients. Certainly, large-scale studies are necessary for verifying the predictivity of MNA-SF in this group of patients.

5. Conclusion

In elderly patients with renal failure, malnutrition is a serious clinical problem that must be identified in early period. MNA is a reliable method for evaluation and early renal replacement, effective therapies for superimposed illnesses and proper nutrient intake are convenient strategies.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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R.K.: carry out the study and draft of the manuscript; B.B.: carry out the study, performed the statistical analysis; A.C.: coordination and draft of the manuscript; P.S.: conception of the study and

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References

[1] Stevens LA, Viswanathan G, Weiner DE. Chronic kidney disease and end-stage renal disease in the elderly population: current prevalence, future projections, and clinical significance. Adv Chronic Kidney Dis 2010;17:293–301.
[2] Garg AX, Blake PG, Clark WF, Clase CM, Haynes RB, Moist LM. Association between renal insufficiency and malnutrition in older adults: results from the NHANES III. Kidney Int 2001;60:1867–74.
[3] Iseki K, Uehara H, Nishime K, Tokuyama K, Yoshihara K, Kinjo K, et al. Impact of the initial levels of laboratory variables on survival in chronic dialysis patients. Am J Kidney Dis 1996;28:541–8.
[4] Mariorca R, Brunori G, Zubani R, et al. Predictive value of dialysis adequacy and nutritional indices for mortality and morbidity in CAPD and HD patients. A longitudinal study. Nephrol Dial Transplant 1995;10:2295–305.
[5] Ciechanover M, Peresecenshi G, Aviram A, Steiner JL. Malrecognition of taste in uremia. Nephron 1980;26:20–2.
[6] Fouque D, Peng SC, Kopple JD. Impaired metabolic response to recombinant insulin-like growth factor-1 in dialysis patients. Kidney Int 1995;47:876–83.
[7] Clinical practice guidelines for nutrition in chronic renal failure. K/DOQI, National Kidney Foundation. Am J Kidney Dis 2000;35:S1–40.
[8] Rubenstein LZ, Harker JO, Salvà A, Guigoz Y, Vellas B. Screening for undernutrition in geriatric practice: developing the short-form mini-nutritional assessment (MNA-SF). J Gerontol A Biol Sci Med Sci 2001;56:366–72.
[9] Ahmed T, Haboubi N. Assessment and management of nutrition in older people and its importance to health. Clin Interv Aging 2010;9:207–16.
[10] Lin SJ, Hwang SJ, Liu CY, Lin HR. The relationship between nutritional status and physical function, admission frequency, length of hospital stay, and mortality in old people living in long-term care facilities. J Nurs Res 2012; 20:110–21.
[11] Raj DS, Welbourne T, Dominic EA, Waters D, Wolfe R, Ferrando A. Glutamine kinetics and protein turnover in end-stage renal disease. Am J Physiol Endocrinol Metab 2005;288:E37–46.
[12] Abdullah MS, Wild G, Jacob V, Milford-Ward A, Ryad R, Zanaty M, et al. Cytokines and the malnutrition of chronic renal failure. Miner Electrolyte Metab 1997;23:237–42.
[13] Raj DS, Dominic EA, Pai A, Osman F, Morgan M, Pickett G, et al. Skeletal muscle, cytokines, and oxidative stress in end-stage renal disease. Kidney Int 2005;68:2338–44.
[14] Jamal SA, Leiter RE, Jassal V, Hamilton CJ, Bauer DC. Impaired muscle strength is associated with fractures in hemodialysis patients. Osteoporos Int 2006; 17:1390–7.
[15] Velasco-Rodriguez R, Perez-Hernandez MG, Mora-Brambila AB, Bazan-Arellano DA, Vasquez C. Serum ferritin and nutritional status in older adults at eldercare facilities. J Nutr Health Aging 2012;16:525–8.
[16] Yamada K, Furuya R, Takita T, Maruyama Y, Yamaguchi Y, Ohkawa S, et al. Simplified nutritional screening tools for patients on maintenance hemodialysis. Am J Clin Nutr 2008;87:106–13.
[17] Kobayashi I, Ishimura E, Kato Y, Okuno S, Yamamoto T, Yamakawa T, et al. Geriatric Nutritional Risk Index, a simplified nutritional screening index, is a significant predictor of mortality in chronic dialysis patients. Nephrol Dial Transplant 2010;25:3361–5.
[18] Hou Y, Li X, Hong D, Zou H, Yang L, Chen Y, et al. Comparison of different assessments for evaluating malnutrition in Chinese patients with end-stage renal disease with maintenance hemodialysis. Nutr Res 2012;32: 266–71.
[19] Campbell KL, Ash S, Bauer JD, Davies PS. Evaluation of nutrition assessment tools compared with body cell mass for the assessment of malnutrition in chronic kidney disease. J Ren Nutr 2007;17:189–95.
[20] Phillips MB, Foley AL, Barnard R, Isenring EA, Miller MD. Nutritional screening in community-dwelling older adults: a systematic literature review. Asia Pac J Clin Nutr 2010;19:440–9.
[21] Ülger Z, Halil M, Kalan I, Yavuz BB, Cankurtaran M, Güngör E, et al. Comprehensive assessment of malnutrition risk and related factors in a large group of community-dwelling older adults. Clin Nutr 2010;29:507–11.
[22] Vischer UM, Frangos E, Graf C, Gold G, Weiss L, Herrmann FR, et al. The prognostic significance of malnutrition as assessed by the Mini Nutritional Assessment (MNA) in older hospitalized patients with a heavy disease burden. Clin Nutr 2012;31:113–7.
[23] Tsai AC, Lu SJ, Chang TL. Modified Mininutritional Assessment can effectively assess the nutritional status of patients on hemodialysis. J Ren Nutr 2009;19:380–8.
[24] Tsai AC, Chang MZ. Long-form but not short-form Mini-Nutritional Assessment is appropriate for grading nutritional risk of patients on hemodialysis–a cross-sectional study. Int J Nurs Stud 2011;48:1429–35.
[25] Tsai AC, Chang TL, Chang MZ. An alternative short-form Mini-Nutritional Assessment for rating the risk of malnutrition in persons on haemodialysis. J Clin Nurs 2013;22:2830–7.
[26] Clinical practice guidelines for nutrition in chronic renal failure. K/DOQI, National Kidney Foundation. Am J Kidney Dis 2001;38:917.
[27] Mitch WE, Maroni BJ. Nutritional considerations in the treatment of patients with chronic uremia. Miner Electrolyte Metab 1998;24:285–9.
[28] Mehrotra R, Berman N, Alistwani A, Kopple JD. Improvement of nutritional status after initiation of maintenance hemodialysis. Am J Kidney Dis 2002;40:133–42.
[29] Pupim LB, Kent P, Caglar K, Shyr Y, Hakim RM, Ikizler TA. Improvement in nutritional parameters after initiation of chronic hemodialysis. Am J Kidney Dis 2002;40:143–51.
[30] Passey C, Bunker V, Jackson A, Lee H. Energy balance in predialysis patients on a low-protein diet. J Ren Nutr 2003;13:120–5.
[31] Lacquaniti A, Bolignano D, Campo S, Perrone C, Donato V, Fazio MR, et al. Malnutrition in the elderly patient on dialysis. Ren Fail 2009;31:239–45.