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Original article

The predictive value of composite methods of nutritional assessment on mortality among haemodialysis patients

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SUMMARY

Background & aims: Several parameters might indicate protein-energy wasting in patients undergoing haemodialysis (HD), and such depletion has been associated with the survival of these patients. Our aim was to identify the parameters that are associated with an increased risk of death among HD patients.
Methods: This was a prospective study with at least 13 months follow-up three times per week of 138 HD patients; 61.6% of the patients were men, 28.9% had diabetes mellitus, and 81.9% had hypertension. The associations of the survival rates based on by Kaplan–Meier analysis with the following nutritional parameters were verified: albumin, lymphocytes, % fat mass (% FM), mid-arm muscle circumference (MAMC), subjective global assessment (SGA), malnutrition-inflammation score (MIS), and nutritional risk screening 2002 (NRS 2002). Cox proportional hazard analysis was used to identify the patients' risk of death (hazard proportional ratio – HR).
Results: The nutritional parameters of lymphocytes and % FM were not associated with the risk of patient death. The patients who were classified as malnourished based on MAMC had a greater risk of death than did those considered nourished, but this difference was not statistically significant. The parameters of serum albumin, SGA, MIS, and NRS 2002 were associated with the risk of patient death (HR = 2.77 $P = 0.042$, HR = 1.88 $P = 0.202$, HR = 4.47 $P = 0.011$, HR = 3.13 $P = 0.022$, respectively), and the latter two parameters were significantly associated with a high risk among malnourished.
Conclusions: The scores for the MIS and NRS 2002 composite methods of nutritional assessment were associated with the highest mortality risk values; thus, in conditions similar to those of our study, we suggest that the use of these parameters should be preferred.

Introduction

Several parameters can be indicative of protein-energy wasting in patients undergoing haemodialysis (HD), which can be observed based on a group of criteria that includes biochemical factors, weight loss, reduced total body fat, decreases in muscle mass, low protein or energy intake and appetite. Moreover, questionnaires and nutritional scores are also potential assessment tools [1].

The use of different parameters, such as subjective, anthropometric and laboratory measures [1], is recommended for the renal patients evaluation, and examinations of the associations of simple and composite methods with survival among HD patients is also suggested [2].

Although serum albumin is influenced by other factors, reductions in this nutritional parameter have been shown to be associated with the risk of death in HD patients [3–8].

Decreases in the production of lymphocytes and the consequent damage to the immune system might increase the risks of infections, morbidity and mortality [9], and malnutrition as measured by reductions in lymphocytes in HD patients is significantly associated with the risk of mortality [10].

In patients undergoing HD, nutritional status deficits can lead to changes in body composition [11]. Some studies have shown that reductions in body fat as assessed by fat mass percentages (%FM) are associated with poor survival [11–13].

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The mid-arm muscle circumference (MAMC) is a measure of the depletion of lean body mass and is significantly lower among individuals who have undergone HD and died within one year of follow-up [10]. Additionally, MAMC has previously been considered an independent predictor of mortality [5,13].

The subjective global assessment (SGA) was developed for surgical patients [14], can identify malnutrition among HD patients [8,15] and is also associated with mortality among patients undergoing HD [16–18]. Various adaptations of the SGA have been established for kidney patients, the use of these adaptations in this population has increased [15].

The malnutrition-inflammation score (MIS) was developed for dialysis patients and is an adaptation of the SGA [17]. The MIS is more sensitive in the detection of malnutrition than is the original adaptation of the SGA [19], and MIS outcomes are associated with the survival of HD patients [2,16,20,21].

The nutritional risk screening 2002 (NRS 2002) is a tool that categorizes individuals as having or not having a nutritional risk and assesses nutritional status and disease severity for the nutritional screening purposes [22]. The only relevant study of HD patients we found reported an association between the presence of nutritional risk and the risk of death [3].

The aim of this study was to identify the nutritional parameters that are associated with an increased risk of death among patients undergoing HD.

Subjects and methods

Patients

This was a prospective cohort study with HD patients that began in 2011. Patients who had been undergoing HD for at least three months at two clinics in the region of Florianópolis, Southern Brazil and were 18 years or older were enrolled in the study. The patients were dialysed three times per week for 3–5 h per day. Patients with body mass indices (BMIs) >34 kg/m^2, amputated or atrophied limbs, pacemakers, cancer, stroke or acquired immunodeficiency syndrome and those who were unable to respond or were hospitalized were excluded. The patients were evaluated between April and August of 2011 and followed for at least 13 months. The monitoring ended in September of 2012.

Demographic data, the duration of HD, the presence of other diseases (e.g., diabetes mellitus, hypertension, and heart failure) and laboratory tests were obtained from the patient records. The study was approved by the Ethics Committee on Human Research of the Federal University of Santa Catarina, and each participant signed a consent form.

Nutritional assessment

These following composite methods were used for the nutritional assessments: SGA, MIS, and NRS 2002.

The SGA evaluated the clinical histories and physical examinations of the patients, which were subjectively rated as follows: A – well nourished, B – moderately nourished or suspected of being malnourished, and C – severely malnourished. The patients in categories B and C were grouped for the statistical analyses [14].

In addition to the components of the SGA [14], the MIS [16] considered the time on HD, the presence of comorbidities, BMI, serum albumin, and total iron binding capacity. The sum of all components results in a score from 0 (normal) to 30 (severe malnutrition). The patients were classified as follows: well-nourished (<6) and malnourished (≥6) [23].

The NRS 2002 assessed the patients' nutritional statuses and disease severities. Each component score was summed, and one point was added to the total for patients ≥70 years of age. The patients were classified based on total scores as follow: without nutritional risk (<3), or with nutritional risk (≥3) [22].

In addition to these composite methods, the following isolate data points were analysed: serum albumin, total lymphocyte, % fat mass (% FM), the sum of four skinfolds, and mid-arm muscle circumference (MAMC). The cut-off points for malnutrition were as follows: serum albumin ≤3.8 g/dL [1]; lymphocytes <2000 cells/mm^3 [24]; % FM <10% [1]; and ≤90% MAMC adequacy [24].

All anthropometric measurements were collected by the same researcher who was trained in the procedures of the standardized body measurements that were performed. The anthropometric evaluation was performed after the end of an HD session. The following equipment was used for these measurements: Cescorf® inelastic tape (Cescorf Equipamentos para Esporte Ltda. – Porto Alegre, Rio Grande do Sul, Brazil), and Lange callipers (Beta Technology Incorporated, Cambridge, Maryland, USA).

Statistical analyses

The data were analysed using with data analysis and statistical software (STATA, version 11 for Windows; Stata Corporation, College Station, TX, USA). The sample is described with the absolute and relative frequencies, means and standard deviations or medians and interquartile ranges of the variables. *T* tests, Mann–Whitney *U* tests, or chi-square tests were used for the bivariate analyses of the clinical characteristics between the patients who survived and died. The gross analyses of the associations between the nutritional parameters and mortality were performed with Kaplan–Meier analysis from which we obtained the survival graphs. Cox proportional hazard analysis was used to identify the patients' risks of death (proportional hazard ratios, HRs), and race, sex, marital status, time on HD, age, education, and the presence of diabetes mellitus and hypertension were considered as potential confounders. Only adjusted variables with *P* values <0.20 were included in the crude analysis. This analysis was used to obtain the values of the density ratio of the incidence of death, i.e., the risk of mortality according to each nutritional parameter. $P < 0.05$ was considered statistically significant.

Results

As shown in the flowchart in Fig. 1, the sample consisted of 138 patients who were undergoing HD. Twenty-five patients refused to participate; these patients did not differ from the rest of the sample in terms of mean age or sex distribution ($P = 0.62$ and 0.20, respectively).

The causes of chronic kidney disease were as follows: 36.2% hypertension, 15.9% diabetes mellitus, 13.8% glomerulonephritis, 8% polycystic kidney disease, and 26.1% other or unknown causes.

The main clinical characteristics of the patients are shown in Table 1 (i.e., nutritional parameters, comorbidities, and adequacy of dialysis). The prevalence of malnutrition according to the nutritional parameters and the incidence of death among the malnourished according to each parameter are shown in Table 2.

Of all of the subjects included in the study, the final outcomes of 19.6% were not investigated; six patients switched from haemodialysis to peritoneal dialysis, six were transferred to other treatment centres, and fifteen underwent renal transplantation.

The cumulative incidence of death during the study period was 12.3% (95% CI 6.7 to 17.9%); these 17 deaths corresponded to an incidence density of 10.8 per 100 persons at risk per year. The causes of death were as follows: 23.5% ($n = 4$) cardiovascular diseases, 17.6% ($n = 3$) pulmonary diseases, 17.6% uncertain causes that