Additional Contribution of the Malnutrition–Inflammation Score to Predict Mortality and Patient-Reported Outcomes as Compared With Its Components in a Cohort of African Descent Hemodialysis Patients

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Objective: The malnutrition-inflammation score (MIS) combines ten components to assess nutritional status. Higher MIS has been associated with higher mortality and poorer health-related quality of life (HRQOL) in maintenance hemodialysis (MHD) patients. It is interesting to investigate associations of each component with mortality and patient-reported outcomes (PROs), that is, HRQOL and depression symptoms, and if MIS associations are generalizable for diverse populations. This study assessed associations of MIS and its components with mortality and PROs in an African descent MHD population.

Design: Prospective cohort for mortality and cross-sectional design for PROs using data of the Prospective Study of the Prognosis of Chronic Hemodialysis Patients (PROHEMO).

Subjects: A total of 632 MHD patients (92% black or mixed race) treated in Salvador, Brazil.

Predictors: MIS (range: 0-30, higher worse) and each of its ten components (range: 0-4, higher worse).

Main Outcome Measures: Mortality, HRQOL using the KDQOL-SF, and depression symptoms using the 20-item Center for Epidemiological Studies Depression Scale.

Statistical Analysis: Linear regression for comparing scores and Cox regression for mortality.

Results: After extensive adjustments, MIS ≥6 was associated with 52% higher mortality (hazard ratio = 1.52; 95% confidence interval = 1.13-2.05), higher depression symptoms, and poorer HRQOL, including physical, mental, and kidney disease–targeted HRQOL measures. Weight change, comorbidity, muscle wasting, and albumin were the MIS components indicating associations between poor nutrition and higher mortality. By contrast, gastrointestinal symptoms and functional capacity were the MIS components denoting detrimental associations of poorer nutritional status with PROs.

Limitation: Causal conclusions are not possible.

Conclusions: The PROHEMO results indicate that MIS components associated with mortality are not the same associated with PROs. However, the MIS showed consistent associations with mortality and PROs. These results in a population that were not the target of previous investigations, add support for using tools combining nutritional components, such as MIS, to predict outcomes in MHD populations.

Introduction

THE MALNUTRITION-INFLAMMATION SCORE (MIS) is a comprehensive scoring system that has been used for quantitative nutritional assessment in maintenance hemodialysis (MHD) patients.[1,2] It is comprised of ten components each representing different aspects of the nutritional and inflammation status of end-stage renal disease (ESRD) patients.[1] Thus, MIS is in keeping with recommendations of the National Kidney

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Financial Disclosure: The authors declare that they have no relevant financial interests.

Support: See Acknowledgments on page 51.

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1051-2276/$36.00

http://dx.doi.org/10.1053/j.jrn.2016.08.006

Foundation Kidney Disease Outcomes Quality Initiative to use a panel of measures to assess the nutritional status of ESRD patients.[3] Higher values of MIS and the MIS components are indications of poorer nutritional status. Studies developed in MHD settings have shown that higher MIS is associated with increased mortality risk and poorer health-related quality of life (HRQOL) assessed by a generic HRQOL instrument.[1,4] MIS has also shown to be a strong prognostic factor in nondialyzed chronic kidney disease and transplant patients.[5–9] The rational for combining different nutritional components to determine MIS is supported by the evidence that each component reflects different mechanisms that result in poor nutritional status such as reduced protein intake and inflammation.[10–12] Considering the diverse nature of the MIS components, it is plausible to hypothesize that they are not associated with the same clinical outcomes, such as mortality and key patient-reported outcomes (PROs), that is, depression symptoms and HRQOL. Thus, it is important to investigate the contribution of each MIS component to the overall prediction performance of MIS for different clinical outcomes. This investigation may provide additional support to the importance of combining nutritional measures for predictive purpose while providing useful information about the utility of specific MIS components to predict particular clinical outcomes in MHD patients.

It is also important to investigate if described associations of MIS with outcomes in MHD patients may be generalized to populations that were not the target of previous investigations, for example, populations with strong African background, such as those from Brazil. Differences in nutritional status and survival by race and ethnicity have been observed in ESRD patients.[13–15] However, these differences do not necessarily mean that an association of a nutritional measure, like MIS, with outcomes varies by race or ethnicity. The demonstration of the generalizability of MIS as a predictor of mortality and PROs is important to assure its validity when used across diverse dialysis settings and ethnically or racially diverse MHD populations.

By using data from patients undergoing MHD in dialysis units of the city of Salvador, Brazil—the city with the biggest African descendant population outside Africa[16]—the present study investigated associations of MIS with mortality and patient-reported outcomes (PROs), that is, HRQOL (both generic and kidney disease–targeted HRQOL) and depression symptoms. It was also assessed if the MIS components associated with PROs were the same associated with mortality.

Patients and Methods

The data are from patients enrolled in the "Prospective Study of the Prognosis of Chronic Hemodialysis Patients," a prospective cohort that has been conducted at four satellite dialysis units in the city of Salvador, BA, Brazil. All patients 18 years or older undergoing maintenance hemodialysis treatment from July 2005 to December 2009 at the participating units were invited to participate in the study. The acceptance rate was superior to 95%. Patients were followed until February 2011. The Institutional Review Board of the Medical School of the Federal University of Bahia, in Salvador, Brazil, approved the study protocol, and all patients gave informed consent to participate.

From a sample of 959 patients undergoing maintenance hemodialysis (MHD) for at least 3 months, 632 had complete baseline data for both MIS and HRQOL scores. Complete baseline data for both MIS and depression symptoms were available for 598 patients. Longitudinal data for the association between baseline MIS and mortality were available for 627 patients. The patients were classified by the interviewers as white, mixed race (black and white) using a predefined criteria based on skin color and other phenotypic characteristics.[17,18] The version of the Kidney Disease Quality of Life Short Form (KDQOL-SF^{TM}) validated for Brazilian patients[19] was used to calculate scores of two generic HRQOL measures, the mental component summary (MCS) and the physical component summary (PCS) and three kidney disease–targeted HRQOL, symptoms/problems, effects of kidney disease, and burden of kidney disease. The scores of PCS and MCS were determined using the algorithms proposed by Ware et al.[20] Range of scores was 14.6 to 61.8 for PCS and 13.7 to 75.0 for MCS. Scores ranged from 0 to 100 for symptoms/problems, effects of kidney disease, and burden of kidney disease. Higher scores indicate better HRQOL. The complete Portuguese version (20-item version) of the Center for Epidemiological Studies Depression scale was used to assess symptoms of depression.[21] Center for Epidemiological Studies Depression scores may range from 0 to 60, with higher scores denoting higher probability of depression.

Certified dietitians, in consultation with attending nephrologists, collected the data used to determine MIS, which is comprised of ten nutritional and inflammation components.[2] Each component of MIS has 4 levels of severity from 0 (normal) to 3 (severely abnormal). We followed recommendations described in previous publication by Rambod et al to determine the patient's score for each MIS component.[2] The MIS is determined by adding up the score of each component and may range from 0 (normal) to 30 (worse nutritional status). Body mass index was determined at dry weight, by dividing body weight in kilograms by the square of height in meters.

Statistical Analysis

The associations of MIS with outcomes were estimated using MIS <6 as reference (≥ 6 vs. <6). The decision to dichotomize MIS into these two groups was based on results of a previous study that suggested the value of 6 for MIS as the best cutoff point to predict the risk of outcomes in MHD patients.[22] For MIS components, the associations with outcomes were estimated using score equal to 0 as reference (scores 1-3 vs. 0). Linear regression models were used to