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Association of nutritional risk and adverse medical outcomes across different medical inpatient populations

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ABSTRACT

Objective: The aim of this study was to examine the prevalence of nutritional risk and its association with multiple adverse clinical outcomes in a large cohort of acutely ill medical inpatients from a Swiss tertiary care hospital.
Methods: We prospectively followed consecutive adult medical inpatients for 30 d. Multivariate regression models were used to investigate the association of the initial Nutritional Risk Score (NRS 2002) with mortality, impairment in activities of daily living (Barthel Index <95 points), hospital length of stay, hospital readmission rates, and quality of life (QoL; adapted from EQ5 D); all parameters were measured at 30 d.
Results: Of 3186 patients (mean age 71 y, 44.7% women), 887 (27.8%) were at risk for malnutrition with an NRS ≥3 points. We found strong associations (odds ratio/hazard ratio [OR/HR], 95% confidence interval [CI]) between nutritional risk and mortality (OR/HR, 7.82; 95% CI, 6.04–10.12), impaired Barthel Index (OR/HR, 2.56; 95% CI, 2.12–3.09), time to hospital discharge (OR/HR, 0.48; 95% CI, 0.43–0.52), hospital readmission (OR/HR, 1.46; 95% CI, 1.08–1.97), and all five dimensions of QoL measures. Associations remained significant after adjustment for sociodemographic characteristics, comorbidities, and medical diagnoses. Results were robust in subgroup analysis with evidence of effect modification (P for interaction < 0.05) based on age and main diagnosis groups.
Conclusion: Nutritional risk is significant in acutely ill medical inpatients and is associated with increased medical resource use, adverse clinical outcomes, and impairments in functional ability and QoL. Randomized trials are needed to evaluate evidence-based preventive and

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treatment strategies focusing on nutritional factors to improve outcomes in these high-risk patients.

Introduction

The prevalence of undernutrition is substantial and may vary significantly across different patient populations. Based on the 2010 nutrition day survey, 32% of hospitalized patients in the Western hemisphere are at risk for malnutrition [1]. Different instruments have been proposed to screen for undernutrition. Among them, the Nutritional Risk Screening (NRS 2002) method is most widely used in European countries including Switzerland [2]. The premise of the NRS 2002 was that the indications for nutritional support should depend on two factors: the severity of impaired nutritional status and the increase in nutritional requirements resulting from disease (stress metabolism). For this reason, the NRS 2002 includes both a measure of current potential undernutrition and a measure of disease severity. Additionally, older age is considered a risk factor. Based on a retrospective analysis of 128 randomized controlled trials (RCTs) against which this method was validated, it was determined that an NRS score $\geq$3 may help to identify patients who would benefit from nutritional support [2]. In fact, the likelihood ratio for a positive effect at cutoffs of 3 and 4 NRS points were 1.7 and 5.

An important limitation of the initial study was that most of the included trials were surgical trials and none included the acutely ill medical inpatient population outside the intensive care unit [2]. A subsequent prospective, controlled trial with 212 hospitalized patients did not show significant effects of nutritional therapy on mortality, hospital length of stay (LOS), or quality of life (QoL), although the negative findings may be the result of a type II error (low power) [3]. This being the case, uncertainty about the potential of the NRS 2002 to identify patients who will or will not benefit from nutritional therapy in the medical inpatient setting persists along with the question of which patient population shows the highest benefit (i.e., cancer patients, infectious disease patients) [4].

Several studies have found associations of nutritional risk and adverse clinical outcome. The EuroOOPS study prospectively collected data in 26 hospital departments in different countries and found high associations of nutritional risk and complications, mortality, and LOS [5]. The aim of this study was to expand these findings and specifically examine the prevalence of nutritional risk and its association across different objective (e.g., mortality, rehospitalization) and subjective (e.g., QoL) adverse clinical outcome measures in a large and well-characterized cohort of acutely ill medical inpatients from a Swiss tertiary care hospital. We specifically asked whether associations between nutritional risk and adverse outcomes would vary across different medical diagnosis groups and after multivariable adjustment in regression models. Such an analysis may help to depict patient populations where nutritional interventions are most promising for inclusion in interventional trials.

Methods

Study design

In this observational cohort study, we included consecutive medical inpatients treated between March 2013 and February 2014 at a Swiss tertiary care hospital. Given that this was an observational quality control study, the Institutional Review Board (IRB) of the Canton of Aargau approved the study and waived the need for informed consent (EK 2012/059). The study was registered at the ClinicalTrials.gov registration website (NCT01768494). All authors had complete access to all the study data, and have reviewed and approved the final manuscript.

Patient population and management of patients

We included adult medical inpatients with an acute medical illness; children and patients hospitalized for surgery were excluded. We collected pertinent clinical information, including sociodemographic characteristics, main medical diagnosis, and comorbidities at hospital admission using the information routinely gathered from the hospital electronic medical system for coding of diagnosis-related group (DRG) codes. This already available information supported the reliable assessment of baseline characteristics and different patient outcomes including in-hospital mortality. We collected left-over blood samples from all patients for later measurement of biomarkers. Structured patient interviews were conducted via telephone 30 d after hospital admission to assess information about the quality of and satisfaction with care and different clinical and functional outcome measures such as location after discharge, QoL measures, performance of activities of daily living (ADLs), hospital readmission, and mortality. If a patient could not be reached, we contacted the family or the general practitioner to assess vital status.

Definitions of main diagnosis and comorbidities

Main diagnosis groups included infectious disease, tumor, immune disorder, metabolic disorder, psychological disorder/intoxication, neurologic disorder, cardiovascular disease, pulmonary disease, digestive tract disease, musculoskeletal disease, and "other" disease. For subgroup analysis, we focused on the following comorbidities coded based on the medical record: diabetes mellitus, tumor, heart failure, chronic obstructive pulmonary disease (COPD), dementia, and renal failure.

Outcome measures

The primary end point of this study was the association of the NRS with different adverse medical outcome measures including mortality within 30 d, functional impairment, QoL, hospital resource use as assessed by time to hospital discharge and readmission rate. QoL was assessed using the EQ-5 D standardized measure of health, which was administered as recommended [6]. Data on QoL were dichotomized into "impairments" (level 1) and "no impairments" (levels 2 and 3). The Barthel Index (BI) was used to measure the performance of ADLs. A BI cutoff of $<$95 points was used to indicate functional impairment.

Assessment of nutritional status and definition of nutritional impairment

Nursing staff assessed the nutritional status within 48 h after hospital admission using the NRS 2002 in a bedside patient interview as recommended [7]. Based on the original publication, risk for malnutrition was defined as an NRS 2002 score of $\geq$3 points.

Statistical analysis

Categorical variables are expressed as percentages/counts and continuous variables as medians (interquartile ranges [IQR], 25th and 75th percentiles), unless stated otherwise. Frequency comparison was done by the χ^2 test. We used multiadjusted regression models to investigate the association of the initial NRS 2002 with adverse medical outcome measures as previously defined. We used logistic models with odds ratios (OR) and relative 95% confidence intervals (95% CI) for all binary end points and Cox regression models with hazard ratios (HR) for time to hospital discharge. Associations of NRS and outcomes were assessed in the overall population and within different predefined subgroups based on sex, age (cutoff 65 y), laboratory findings (albumin 35 g/L and 30 g/L cutoff, C-reactive protein [CRP] 10 mg/L cutoff), and main medical diagnosis. We investigated evidence of effect modification by including interaction terms into the statistical models with a $P < 0.05$ indicating significant effects. To adjust for possible confounding three statistical models were used: model 1 for age and sex; model 2 for age, sex, and comorbidities; model 3 for age, sex, comorbidities, and main diagnosis. All statistical analyses were performed with STATA 12.1