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Nutritional screening for risk prediction in patients scheduled for extra-abdominal surgery

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ABSTRACT

Objective: The Nutritional Risk Screening-2002 (NRS-2000) is currently recommended by the European Society of Parenteral and Enteral Nutrition as a screening tool in hospitalized patients. However, for preoperative risk prediction, the usefulness of this tool is uncertain and may depend on the type of surgical disease. The present study investigated the relative prognostic importance of the NRS-2002 and of established medical and surgical predictors for postoperative complications in patients scheduled for non-abdominal procedures.

Methods: In this prospective observational study, we enrolled 581 patients scheduled for elective non-abdominal surgery. Data were collected on nutritional variables (body mass index, weight loss, and food intake), age, gender, type of surgery, extent of surgery, underlying disease, American Society of Anesthesiologists class, and comorbidity. We also evaluated a modification of the NRS-2002 (ordinal graduation according to <2 or ≥ 2 points) and the importance of individual parameter values. Relative complication rates were calculated with generalized linear models and cumulative proportional odds models.

Results: Forty-four patients (7.6%) sustained at least one postoperative complication. The frequency of this event increased significantly with a higher NRS-2002 score. However, the model that performed the best (sensitivity 81.8%, specificity 78.6%) included the modified NRS-2002 graduation (<2 or ≥ 2 points) and other factors such as American Society of Anesthesiologists class, the duration of the procedure, and the need for red blood cell transfusion.

Conclusion: In surgical patients with non-abdominal diseases, a modified NRS-2002 classification may be required to preoperatively identify patients at a high nutritional risk. The NRS-2002 alone is insufficient to precisely predict complications.

Introduction

For nutritional risk screening in adult hospitalized patients, the European Society for Clinical Nutrition and Metabolism currently recommends the Nutrition Risk Screening-2002 (NRS-2000) as the preferred screening tool [1,2]. The NRS-2002 has shown a superior performance (higher sensitivity and specificity for predicting complications) compared with other screening tools such as the Malnutrition Universal Screening Tool, the Mini Nutritional Assessment Short Form, or the Nutritional Risk Indicator [3,4]. The NRS-2002 may even perform better than established assessment tools such as the Subjective Global Assessment if more severe and rarer complications are to be predicted [5,6].

Recently, the NRS-2002 has been increasingly used for preoperative risk assessment. However, the usefulness of the NRS-2002 for risk prediction in surgical patients, especially in those awaiting abdominal surgery, is uncertain. Schiesser et al. [7], Guo et al. [8], and Schwegler et al. [9] examined the capability of the NRS-2002 to predict postoperative complications. Although the incidence of severe postoperative complications was higher in patients at nutritional risk (NRS-2002 score ≥ 3), corresponding sensitivities were consistently poor (varying from 30% to 50%). Only specificities were sometimes acceptable (62% to 89%).

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Similar results were obtained by a recent study from our institution, where we had thoroughly examined the predictive importance of different graduations and components of the NRS-2002 in patients scheduled for elective abdominal surgery [10]. According to our results, the exclusive preoperative risk prediction by the NRS-2002 is less precise than a prediction by a complex model, which does not use the NRS-2002 classification but is based on clinical predictor variables reflecting medical and surgical conditions and on feeding habits before hospital admission. Only when applying such a complex model was it possible to predict postoperative complications reliably (sensitivity 79.7%, specificity 76.6%).

In contrast to patients undergoing surgery for abdominal diseases, very little is known about the usefulness of the NRS-2002 in surgical patients with non-abdominal diseases. It is highly likely that the importance of nutritional variables for postoperative risk prediction varies depending on whether a patient presents with an abdominal disease or not. Compared with abdominal surgical patients, patients with non-abdominal vascular, orthopedic, or thoracic diseases might have fewer detrimental nutritional consequences from their primary disease and surgery.

In the present study, we specifically examined the usefulness of the NRS-2002 for predicting postoperative complications in patients scheduled for non-abdominal surgery. The predictive performance of the NRS-2002 was adjusted to that of established medical and surgical predictor variables (such as the American Society of Anesthesiologists [ASA] class or the number of transfused red blood cell units). Furthermore, because it is unclear which components of the NRS-2002 are particularly relevant for postoperative risk prediction, we separately tested the different graduations of this score and the individual parameter values contained in this score. The design of the present study is identical to that of a previous study examining patients treated for abdominal diseases in our institution [10].

Materials and methods

Study design

The present study was a prospective observational cohort study that was performed in patients scheduled for an extra-abdominal surgery in the Department of Surgery, Ludwig Maximilians University, Grosshadern Campus, Munich, Germany. The primary dependent study variable was the documentation of a patient with at least one postoperative complication. The study was designed to permit the detection of a two-fold difference in the incidence of at least one complication between two unequal groups (patients who were and those who were not nutritionally at risk). In patients scheduled for non-abdominal (e.g., orthopedic) surgery, we assumed 20% to be at an increased nutritional risk. For patients who were not nutritionally at risk, we assumed a postoperative complication rate of 10% [6,11] and, hence, the study had to collect at least 630 preoperative patients to detect a two-fold increase in frequency (two-sided type I error 5%, power 80%). The prospective data collection was approved by the local institutional review board and each patient consented in writing to an anonymous data analysis.

Enrollment

Eligible patients were consecutively enrolled in the study beginning in March 2009; enrollment was complete by July 2010. Eligible patients were hospitalized, were at least 18 y old, and presented with a non-abdominal disease (thoracic, vascular, or orthopedic) requiring elective surgical therapy. No patient received specific perioperative nutritional support. Patients were excluded if they presented with a severe comorbidity (end-stage renal failure requiring renal replacement therapy, chronic obstructive pulmonary disease requiring home oxygen therapy, severe heart failure [New York Heart Association class IV], severe liver cirrhosis [Child class C]), or if they were pregnant, unable to consent, or were scheduled for an emergency surgery.

On admission, each patient had a thorough clinical examination by a resident of the corresponding service. After enrollment, a standardized data-collection form was completed by a dietitian and a physician to provide information about the patients' histories. The local advisors of the study (W. Hartl and P. Rittler) approved the final version of the form.

Patient history

In addition to age and gender, this form included information about the non-surgical comorbidities of a patient. Comorbidities were classified according to organ systems (cardiovascular, pulmonary, gastrointestinal, neurological, diabetic, renal, and hematologic). Only those comorbidities were registered that required a specific therapy. In patients with several comorbidities, specialists were asked to name the comorbid condition considered the most relevant threat to a patient's postoperative well-being. We specifically recorded the type of underlying surgical disease (malignant or benign) and the type of the planned surgical procedure (orthopedic, thoracic, vascular, or cervical). We also classified patients according to ASA class.

Nutritional assessment

Nutritional assessment was performed on admission day (usually 1 to 2 d before surgery). We obtained information on preoperative changes of body weight, feeding habits, and fluid retention (presence or absence of edema). The patients' height and body weight at admission were measured using a calibrated scale to calculate individual body mass index (BMI) values.

Definition of nutritional risk

To describe nutritional risk, we used the NRS-2002 score [12]. The NRS-2002 is based on four variables—weight loss, BMI, general condition, and amount of food intake during the week before hospital admission (compared with what would have been considered as normal by the patient)—in addition to the patient's age and severity of underlying disease. Nutritional risk was evaluated by two components (nutritional score and severity of disease score) assigning a certain number of points to a patient. Details of the screening procedure and of the assignment of score points were presented in a previous publication [10]. When achieving at least 3 total score points, a patient may be considered at high nutritional risk [12].

To classify a patient's nutritional risk in the context of our study, three different nutrition-related variables were tested. 1) Individual parameter values contained in the NRS-2002 representing the BMI, comorbidity, type of underlying disease, type of surgical procedure, percentage of weight loss per month, and percentage of food intake in the preceding week were analyzed. This analytical strategy was incorporated into the study because our recent study in patients scheduled for abdominal surgery found that, in the latter patients, the percentage of food intake before hospital admission compared with normal food intake was the only nutrition-related variable predicting a postoperative complication [10]. 2) A two-stage graduation according to NRS-2002 score points (not at risk <3 points, at risk ≥ 3 points) and 3) a modified two-stage graduation according to NRS-2002 score points (not at risk <2 points, at risk ≥ 2 points) were analyzed. These analyses were applied because an exploration of the data showed that the frequency of complications did not monotonically increase with a higher NRS-2002 score.

Characteristics of surgical trauma

We registered the duration of the procedure (minutes) and the number of allogeneic red blood cell concentrates that had been transfused perioperatively. The blood transfusion policy followed guidelines issued by the German Medical Association [13].

Data accuracy

The accuracy of data in the form was ensured by the specific qualification of the research staff. All patients were assigned a unique code during a single hospital visit, and the forms were transmitted to a departmental depository without identification of the patient. Each patient form was checked for completeness and plausibility by members of the local advisory board.

Dependent variable

The primary dependent variable of the study was identification of any (one or several) postoperative complication in a patient. Outcome (morbidity or mortality until hospital discharge) was assessed by residents of the corresponding surgical service, who were blinded to the results of the nutritional risk screening.