Original article

Evaluation of nutritional status as an independent predictor of post-operative complications and morbidity after gastro-intestinal surgery

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A R T I C L E   I N F O

S U M M A R Y

Background: Nutritional Risk Screening-2002 (NRS-2002) and the Malnutrition Universal Screening Tool (MUST) are screening tools for nutritional risk that have also been used to predict post-operative complications and morbidity, though not all studies confirm the reliability of nutritional screening. Our study aims to evaluate the independent predictive value of nutritional risk screening in addition to currently documented medical, surgical and anesthesiological risk factors for post-operative complications, as well as length of hospital stay.
Methods: This study is a prospective observational cohort study of 129 patients undergoing elective gastro-intestinal-surgery. Patients were screened for nutritional risk upon admission using both MUST and NRS-2002 screening tools. Univariate and multivariate analyses were performed to investigate the independent predictive value of nutritional risk for post-operative complications and length of hospital stay.
Results: MUST ≥ 2 (OR 2.87; 95% CI 1.05—7.87) and peri-operative transfusion (OR 2.78; 95% CI 1.05—7.40) were significant independent predictors for the occurrence of post-operative complications. Peri-operative transfusion (HR 2.40; 95% CI 1.45—4.00), age ≥ 70 (HR 1.50; 95% CI 1.05—2.16) and open surgery versus laparoscopic surgery (HR 1.39; 95% CI 0.94—2.05) were independent predictors for increased length of hospital stay, whereas American Society of Anesthesiology Score (ASA) and MUST were not.
Conclusion: Nutritional risk screening (MUST ≥ 2) is an independent predictor for post-operative complications, but not for increased length of hospital stay.

1. Introduction and rationale

In Western Europe approximately 30% of all patients admitted to hospital are undernourished [1,2]. During hospital stay the nutritional status of patients has been shown to decline further [3,4]. Malnutrition has been shown to impair immune function, delay wound healing and convalescence from illness, and to decrease functional status [5].

Several screening tools have been developed for recognizing nutritional risk [6]. European ESPEN guidelines suggest a screening tool for in-hospital use, called the NRS-2002 (nutritional risk screening) [1]. In the Netherlands however, the NRS-2002 is not widely implemented due to its more time consuming questionnaire. Instead, more compact screening tools, such as the MUST (Malnutrition Universal Screening Tool) and SNAQ (Short Nutritional Assessment Questionnaire) have been widely implemented [7].

Nutritional screening tools were developed and validated to recognize nutritional risk and evaluate therapeutic effect [6]. The NRS-2002 has also been used to predict post-operative complications and morbidity, though not all studies confirm the reliability of nutritional screening for this purpose [8—11]. Our study aims to

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evaluate the independent predictive value of nutritional risk screening for post-operative complications after major gastro-intestinal surgery, as well as for length of hospital stay, in addition to currently documented medical, surgical and anesthesiological risk factors.

2. Study design & methods

This study is a prospective observational cohort study of patients undergoing elective surgical intervention at VieCuri teaching hospital in the south of the Netherlands. Patients aged 18 years and older undergoing elective surgery to the gastro-intestinal tract between October 2012 and July 2013 were eligible for participation. We opted to include patients undergoing major gastro-intestinal and colorectal surgery, thus patients undergoing appendectomy and cholecystectomy were not eligible for participation (Table 1). One hundred thirty eight patients were approached for participation, of whom 9 refused enrolment in the study. Exclusion from participation was on the basis of an ASA-classification V, severe liver cirrhosis − Child grade C, end stage renal disease requiring dialysis, severe heart disease − New York Heart Association class IV and chronic obstructive pulmonary disease (COPD) requiring (home)oxygen therapy (N = 0).

Prior to this study a nutritional screening and intervention algorithm had successfully been implemented at our hospital in accordance with ESPEN guidelines. All Patients were screened using the MUST screening tool upon evaluation upon hospital admission. For the benefit of this study the NRS-2002 was used alongside the MUST [1]. Patients with MUST scores of 2 or higher and/or NRS-2002 scores of 3 or higher received nutritional intervention before surgery, in accordance with ESPEN guidelines. As a nutritional screening and treatment algorithm was already in place no change in the nutritional intervention regime was implemented in this study.

Besides nutritional status the presence of known risk factors for post-operative complications were recorded: age (<70 and ≥70), ASA-classification (<3 and ≥3), underlying disease (malignant or benign), planned type of procedure (laparoscopic or open: conversion from laparoscopic to open surgery was classified as open surgery), perioperative anemia (any deviation from normal haemoglobin ranges) and peri-operative blood transfusion. Comorbid disease was categorized according to the Charlson Comorbidity Index. In the Charlson Comorbidity index a weighted score is assigned to each of 17 comorbid conditions, the sum of the index score is an indicator of disease burden, and an estimator of mortality. For the analysis we classified the Charlson index as a binary outcome, ≥3 being an increased comorbidity risk.

The primary endpoint was post-operative complications. Post-operative complications were categorized by severity as proposed by Clavien-Dindo [12]. According to this classification,

complications are defined as any deviation from the normal post-operative course. Complications were graded from I to V, based on the extent of intervention needed to correct the complication. In the case of several complications these were recorded separately, and in this case the most severe complication was used in statistical analysis. For the initial analysis we classified postoperative complications as a binary outcome: complications graded 2 or higher were categorized as the occurrence of post-operative complications, whereas grade 0 and 1 were graded as no complications. We also evaluated the influence of our study variables on an increase in complication severity, by using a proportional odds model, as described in statistical methods. This analysis selectively included grade one complications. Of grade one complications we only included wound infections opened at bedside in our study (N = 7).

Length of hospital stay was the secondary endpoint and was defined as time from admission until time of discharge (in days). In our institution patients are admitted on the day of surgery. In four cases patients were admitted a week prior to surgery for preoperative nutritional support. In these cases length of hospital stay was classified as time from the day of surgery until the day of discharge.

It was our goal to determine the independent predictive value of nutritional risk, and in the process create a risk-stratification for the occurrence of operative complications and increased length of hospital stay. We intended to differentiate between risk factors that are known pre-operatively and those that become apparent peri-operatively. We therefore created pre-operative multivariate model as well as a peri-operative model for both our primary and secondary outcome measures. Ethical approval was granted for this study by a local medical ethics committee.

2.1. Statistical analysis

2.1.1. Univariate analyses

Univariate analyses were used to determine the association between each individual variable and the outcome variables. The association between MUST, NRS-2002, age (<70 and ≥70), ASA-classification (<3 and ≥3), underlying disease (malignant or benign), comorbidity (Charlson Index), type of procedure (laparoscopic or open), peri-operative anemia, peri-operative transfusion on the one hand, and the occurrence of complications on the other hand were tested with the chi-square method. For analyzing the association between the above mentioned predictors and time to hospital discharge the log rank test was performed.

2.1.2. Multivariate analyses

Multiple logistic regression analysis was used to analyze the independent association between patient, disease and treatment characteristics on the one hand and the occurrence of post-operative complications (yes versus no) on the other hand. Cox proportional hazard regression analysis was used to evaluate the independent association between patient, disease and treatment characteristics on the one hand and time to hospital discharge on the other hand. Only independent variables with a significant association in univariate analyses were included in multivariable analyses. All statistical analyses were performed by using SPSS version 20.0.

2.1.3. Proportional-odds model

To evaluate the influence of our study variables on severity of complications according to the Clavien-dindo score (ordinal outcome), ordinal logistic regression analysis were performed. Univariate ordinal logistic regression analyses were used to determine the association between each individual predictive variable and the outcome variable (an increase of the Clavien-dindo score).

Table 1
Type of surgery.

Operation	Frequency n (%)
Hemi-colectomy	31 (23)
Colo-ileostomy reversal	25 (19)
Rectum resection/amputation	20 (16)
Sigmoid resection	19 (15)
Colo-ileostomy	11 (9)
Gastric surgery	10 (7)
Liver segment resection	6 (5)
Extensive abdominal surgery	5 (4)
Ileocaecal resection	2 (2)
Total	129