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Original article

The Geriatric Nutritional Risk Index predicts hospital length of stay and in-hospital weight loss in elderly patients

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SUMMARY

Background & aims: Nutritional derangements are common in elderly patients, but how nutritional risk affects outcome in this subset of hospital inpatients deserves further investigation.
We evaluated the impact of nutritional risk on length of stay (LOS) and in-hospital weight loss (WL) in elderly patients (>65yrs).
Methods: Nutritional risk was assessed by the Geriatric Nutritional Risk Index (GNRI) in a prospective multicentre hospital-based cohort study. The outcomes were LOS and in-hospital WL.
Results: In the whole sample ($N = 667$), the prevalence of high (GNRI < 92) and mild (GNRI: 92–98) nutritional risk were 33% and 25%, respectively. Patients with a high nutritional risk were more likely (OR = 1.89; 95%CI: 1.22–2.92) to stay longer in hospital (fourth quartile, LOS ≥ 20 days) compared to those without. Other factors associated with prolonged LOS were cancer diagnosis (OR = 2.52; 95%CI: 1.69–3.75), the presence of comorbidities (OR = 1.24; 95%CI: 1.11–1.40) and surgical setting (OR = 1.65; 95%CI: 1.10–2.47). In-hospital WL ≥ 5% was recorded in 75 ambulant patients from a representative subgroup ($N = 583$). It was independently associated with prolonged LOS (OR = 1.80; 95%CI: 1.03–3.06) and was more frequent among cancer patients (OR = 1.88; 95%CI: 1.09–3.24), in patients with a high nutritional risk (OR = 2.23; 95%CI: 1.20–4.14) or those admitted to surgical units (OR = 1.77; 95%CI: 1.02–3.05).
Conclusions: Nutritional risk assessed by the GNRI on admission, predicts LOS and in-hospital WL in elderly patients.

1. Introduction

The independent role of nutrition in affecting the prognosis of hospitalized patients is well known. Disease-related malnutrition has been shown to be associated with higher mortality and morbidity, prolonged recovery from illness and length of stay (LOS).[1–3] Furthermore, nutritional status may deteriorate during hospitalization.[1,2,4] Advanced age has been associated with poor adaptation to disease-related metabolic stress[5] and is recognized as an independent predictor of nutritional derangements and worse clinical outcome.[1,6]

The use of screening procedures to assess nutritional risk before/during hospital admission is recommended so as to identify patients who may benefit from nutritional support.[7] To this end, different tools have been introduced in clinical practice; although they provide different information, in theory, they focus on the same issue.[7,8] Nevertheless, the use of a tool should be initially validated against prediction of outcomes. Validation should also specifically take into account the specific setting and population.[9] As the numbers of elderly people are growing, and given the intrinsic nutritional needs among this group of patients, the validation of putatively age-specific assessment tools has a rationale.[9] Moreover, elderly patients may frequently be unable to take part in nutritional screening procedures.

In accordance with these claims, a specific prognostic index for the elderly, the Geriatric Nutritional Risk Index (GNRI), has been proposed.[10,11] Its use appears to be promising and preliminary

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studies have suggested a better association with acute care outcomes.[12,13] However, most of the literature on GNRI is focused on long-term care settings. Very little research has been done on use of the GNRI in the acute setting.[9,14–16]

The aim of this study was to investigate the impact of nutritional risk, as assessed by the GNRI, on length of stay (LOS) and nutritional status during hospitalization in elderly patients.

2. Methods

This was a prospective multicentre cohort study in an acute hospital setting. Assessment procedures were performed in line with principles set down by the Declaration of Helsinki. It was approved by the local Institutional Ethics Committees and all the patients were asked to provide their written informed consent.

From March 2009 to April 2012, all patients over 65 who were admitted to the hospitals were systematically screened to assess whether they met study inclusion criteria. Patients were recruited and enrolled from both medical (general internal medicine, gastroenterology, pneumology, cardiology, nephrology, oncology, haematology, dermatology, ophthalmology, rheumatology and infectious diseases) and surgical departments (general and abdominal surgery, cardiothoracic surgery, urology, gynaecology, vascular surgery, maxillofacial surgery and otorhinolaryngology). Exclusion criteria were: admission to intensive care units and other emergency settings, presence of fluid retention, haemodialysis, same-day surgery, one-day-care admission admissions and LOS < 3 days. Terminally ill patients were also excluded. All the assessment procedures were performed within 36 h of admission. We collected data on: gender, age, ward admission, main diagnosis, number of comorbidities (excluding malnutrition) and nutritional parameters.

2.1. Nutritional assessment

We collected the following nutritional parameters: height (measured or estimated from knee-height, when this proxy indicator was more accurate),[17] weight, body mass index (BMI; in kg/m^2) and serum albumin.

Nutrition-related risk of complications was assessed by the GNRI.[9,10] The GNRI is a dichotomous index, combining two nutritional indicators: albumin and actual weight compared with ideal body weight.

$$\mathrm{GNRI} = (1.487 \times \text{serum albumin, [g/L]}) + (41.7 \times (\text{present/usual weight[kg]})).$$

Patients were then classed as being at: high risk, <92; mild risk, 92 to 98; no risk, >98.[9]

Similarly to previous investigations[12,13,18] and unlike the original grouping into four classes proposed by Bouillanne et al.,[10] we avoided distinguishing the 'severe risk' group (GNRI, <82) from the 'moderate risk' one (GNRI, 82–92), as both groups have been demonstrated to present a high risk of complications.[10] Moreover, in respect to intervention, distinguishing between these degrees of risk does not require a different approach.

Body weight was also recorded when patients were discharged to evaluate in-hospital weight loss.

Nutritional support was provided on request by the admissions department, and monitored by the Nutrition and Dietetics Service, in accordance with International Guidelines.[19,20]

2.2. Outcomes

Length of hospital stay (LOS) was the primary outcome. It was determined as the number of days of hospitalization, including the date of admission and excluding that of discharge. Prolonged hospitalization was defined as a LOS in the 4th quartile (computed to ≥20 days). Secondary outcome was a weight loss ≥5% (WL ≥ 5%) during the period of hospitalization. Dying patients and those who were discharged within three days were not included in the final analyses.[2]

2.3. Statistical analysis

Based on hospital statistics and previous results regarding the use of the GNRI as a screening tool in the hospital setting,[15] we computed an expected prevalence of high nutritional risk (GNRI < 92) of 35%, with an overall nutritional risk (GNRI ≤ 98) of up to 50%. An enrolment of 714 patients would therefore result in a two-sided 95% confidence interval (95%CI) between 31.5% and 38.5% for the prevalence of high nutritional risk and between 46.3% and 53.7% for overall nutrition risk. Parametric (Student's unpaired *t*-test or ANOVA analysis) and non-parametric tests (Mann–Whitney *U*-test or Kruskall–Wallis tests) were used for between-group comparison of continuous variables with normal and non-normal distribution, respectively. Frequencies were compared by Chi-square test.

Multivariable logistic regression models were used to identify the independent predictors of the outcomes considered. Odds ratios (ORs) and 95%CI were provided accordingly. Prior to inclusion in the models, collinearity between all possible covariates was assessed by Pearson's statistic. Due to the collinearity between cancer diagnosis and nutritional support, this last variable was not included in the multivariate models. Statistical analyses were performed using MEDCALC® software for Windows, Version 11.3.0.0 (MedCalc Software, Mariakerke, Belgium). The level of significance was established in a two-sided P value < 0.05.

3. Results

3.1. Assessment of the study cohort

A total number of 735 patients were assessed; 33 (4%) and 35 (5%) patients were excluded from final analysis due to LOS < 3 days and death, respectively; 667 subjects were included in the final analysis. Table 1 classifies these patients according to their main diagnoses on admission. The prevalence of high nutritional risk (GNRI < 92) was similar in patients who died during hospitalization (36.7% vs. 32.8%; $P = 0.811$), and no differences were detected in baseline nutritional parameters and significant in-hospital weight loss (≥5%; 14% vs 11%; $P = 0.78$). A trend towards a prolonged LOS (14 days [25th–75th, 8–24] vs 11 days [25th–75th, 7–20], $P = 0.115$) was also detected. However, a higher number of comorbidities was found in patients who died in hospital (4 [25th–75th, 3–5], vs 3 [25th–75th, 1–4], $P < 0.001$). No significant differences were detected in patients who had been discharged early (<3 days) and those included in the final analyses for any variable considered. On discharge, the weight of 583 ambulant patients was reassessed and findings among this sub-group were similar to those of the original population ($P > 0.05$ for all parameters investigated; Table 2). The lack of data on body weight on discharge was related mainly to patients who were bedridden or discharged without prior notice.

3.2. Nutritional risk and hospital outcome

In the final study sample, the prevalence of high, mild and no nutritional risk was 33%, 25% and 42%, respectively. The prevalence of overall nutritional risk was thus computed to 58% (95%CI 54–62). Increasing nutritional risk was associated with lower BMI and

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