



## Original article

# Comparison of nutritional status assessment parameters in predicting length of hospital stay in cancer patients



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## SUMMARY

**Background & aims:** Undernutrition has been associated with an increased length of hospital stay which may reflect the patient prognosis. The aim of this study was to quantify and compare the association between nutritional status and handgrip strength at hospital admission with time to discharge in cancer patients.

**Methods:** An observational prospective study was conducted in an oncology center. Patient-Generated Subjective Global Assessment, Nutritional Risk Screening 2002 and handgrip strength were conducted in a probabilistic sample of 130 cancer patients. The association between baseline nutritional status, handgrip strength and time to discharge was evaluated using survival analysis with discharge alive as the outcome.

**Results:** Nutritional risk ranged from 42.3 to 53.1% depending on the tool used. According to Patient-Generated Subjective Global Assessment severe undernutrition was present in 22.3% of the sample. The association between baseline data and time to discharge was stronger in patients with low handgrip strength (adjusted hazard ratio, low handgrip strength: 0.33; 95% confidence interval: 0.19–0.55), compared to undernourished patients evaluated by the other tools; Patient-Generated Subjective Global Assessment: (adjusted hazard ratio, severe undernutrition: 0.45; 95% confidence interval: 0.27–0.75) and Nutritional Risk Screening 2002: (adjusted hazard ratio, with nutritional risk: 0.55; 95% confidence interval: 0.37–0.80).

**Conclusions:** An approximate 3-fold decrease in probability of discharge alive was observed in patients with low handgrip strength. Decreasing handgrip strength tertiles allowed to discriminate between patients who will have longer hospital stay, as well as undernutrition and nutritional risk assessed by Patient-Generated Subjective Global Assessment and Nutritional Risk Screening 2002.

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## 1. Introduction

In cancer patients undernutrition is common and is associated with a worse quality of life, increased morbidity and mortality.<sup>1</sup> Although Patient Generated Subjective Global Assessment (PG – SGA) is the method recommended by the American Society for Parenteral and Enteral Nutrition (ASPEN) for the diagnosis of undernutrition in these patients,<sup>2</sup> other tools are often used.<sup>3</sup> The European Society for Clinical Nutrition and Metabolism (ESPEN) recommends the Nutritional Risk Screening 2002 (NRS 2002) as a

method for screening undernutrition in hospitalized patients<sup>4</sup> and ASPEN also recommends handgrip strength (HGS) as one of the six characteristics to detect and diagnose undernutrition.<sup>5</sup>

Undernutrition identified by PG – SGA, NRS 2002 and low HGS have been associated with an increased length of hospital stay which may reflect the patient prognosis and has been frequently used as an outcome.<sup>6,7</sup> The association of HGS with length of stay was quantified only in patients with diagnosis of pneumonia and aged over 75,<sup>8,9</sup> while length of hospital stay analysis did not take into account if the patient was discharged alive.<sup>8</sup>

A comparative survival analysis had never been used to assess the performance of HGS and of other nutritional status assessment parameters in predicting length of stay in cancer patients.

The aim of this study was to quantify and compare the association between nutritional status at hospital admission, assessed by PG – SGA and NRS 2002, and HGS with time to discharge in cancer patients.

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## 2. Methods

### 2.1. Study design

An observational prospective study during in-hospital stay was conducted in an oncology center in the metropolitan area of Porto, Portugal (Portuguese Institute of Oncology Francisco Gentil, Porto, EPE), between January and April 2008. It is the main hospital for cancer treatment for the North of Portugal.<sup>10</sup>

The study was designed and conducted in accordance with the Declaration of Helsinki and was approved by the institutional board and ethics committee of hospital.<sup>11</sup>

### 2.2. Study sample

A total of 130 patients admitted to medical and surgical wards were recruited in the hospital. The main hospital wards were Medical and Surgical Oncology and Radiotherapy (Brachytherapy), where patients had been admitted according to therapeutic intervention. The total capacity of the hospital was 352 beds, there were 55 beds in medical wards while 160 beds were present in surgical wards.<sup>10</sup> A systematic sampling approach was used, which consisted of selecting the first of every two admitted patients who met the inclusion criteria.

Patients were considered eligible if they were over 18, able to give informed consent and with a stay longer than 24 h. Exclusion criteria were being pregnant, having upper limb deformities and being unable to perform HGS measurements. The latter criterion included all the situations that lead to inability to understand the explanations and to perform the technique correctly, namely: osteoarticular diseases or others, pain, sedation, comatose status, confusion and moderate/severe neurological and/or cognitive impairment or critical illness, defined as the failure of one vital organ needing intensive care.<sup>12,13</sup> Patients admitted to palliative care were not included, because most of them had characteristics considered as an exclusion criterion e.g. sedation or comatose status to perform HGS correctly.

### 2.3. Data collection and variable definition

All data were collected by a single interviewer who had been previously trained.

Information about sex, age, date of admission and diagnosis was collected from clinical files. The number of completed years of schooling was reported directly by patients when this information was not available in their files.

The TNM Classification of Malignant Tumours (TNM) was used to describe disease staging in solid tumors<sup>14</sup> and Grading was used to describe cell appearance in liquid tumors.<sup>15</sup> In 5.4% ( $n = 7$ ) of all cases the information about disease staging or grading of tumors was absent.

Katz Index of activities of daily living was used to characterize functional status.<sup>16</sup> The patient was considered severely dependent if he was able to perform only two or less of the six activities of daily living considered in the scale; moderately dependent if he was able to perform three to five activities; totally independent if he performed all the six activities.<sup>16</sup>

Anthropometric data collected included weight and height. Patients were weighed wearing light clothes, using a mechanical scale to the nearest 0.1 kg and height was measured with a fixed tape to the nearest 0.1 cm.<sup>17</sup> In cases where patients had been weighed and measured by the nurse in the last 48 h ago, those measurements recorded in the clinical files were considered (weight,  $n = 20$ , 15.4%; height,  $n = 62$ , 47.7%). Weight and height were used to calculate body mass index (BMI), ( $BMI = \text{weight [kg]} / (\text{height [m]})^2$ ).<sup>18</sup>

PG – SGA and NRS 2002 were applied for assessing nutritional status on patients' admission.<sup>2,4</sup> PG – SGA is a nutritional assessment method adapted by Ottery for cancer patients.<sup>2</sup> It consists of two sections, the first section includes questions about recent weight loss, food intake, symptoms that could interfere with food intake and patients' physical activity. In the second section, information is collected about disease and metabolic needs while a patients' physical examination is carried out. Each item of PG – SGA rated has a score and the final score indicates the need or not of nutritional intervention. It also originates an overall subjective rating, a patient may be “well nourished or anabolic (SGA - A)”, “at nutritional risk or moderate undernutrition (SGA - B)” or “severe undernutrition (SGA - C)”.<sup>2</sup>

NRS 2002 classifies the nutritional status based on BMI, percentage of recent weight loss, recent change in food intake and disease severity. One point is added if patients are  $\geq 70$  years. When the final score is  $\geq 3$  points, the patient is considered at nutritional risk.<sup>4</sup> As part of ethical screening practice, participants identified as being at nutritional risk by either method were referred to their medical doctors and nutritionists.

HGS was measured by a mechanical handgrip dynamometer (*Smedley® Hand*) in the first 48 h of admission. Kilogram-force (KgF) was the unit used for HGS, it is a gravitational metric unit of force. It is equal to the force exerted by one kilogram of mass in a standard gravitational field. Therefore, 1 KgF is by definition equal to 9.80665 N.<sup>19</sup> The handgrip dynamometer was calibrated in a metrology accredited center which allowed the error estimate and further data correction as: measurement (KgF) = observed measurement – error. We estimated the error to be: error =  $0.0604 \times \text{measurement} - 1.5143$ .<sup>20</sup> After explaining the procedure to each patient, HGS measurement was performed. Patients were sitting in a chair or in case of bedridden patients remained lying on the bed flexed to 30° with the arm by the side of the body and the forearm stretched to an angle of 90°. The maximum value of three consecutive measurements in the non-dominant arm was registered. Brief pauses were taken between measurements. Patients used their dominant hand when they were unable to perform HGS with their non-dominant hand.<sup>21,22</sup> The chosen method to present results was division by tertiles as has been adopted previously.<sup>9</sup> As HGS is higher among men, sex-specific tertiles in the study sample were determined. High strength was defined as above 19.84 KgF in women and 34.39 KgF in men. Intermediate strength was considered between 14.68 and 19.84 KgF in women and between 25.00 and 34.39 KgF in men. The highest HGS sex-specific tertile was used as reference.

Length of stay was calculated as the difference between the day of admission and the day of hospital discharge.

### 2.4. Data analysis

Using the Kolmogorov–Smirnov test were identified variables that followed a normal distribution. Means and their standard deviation (SD) values are presented for normal distributed data and medians and interquartile range (IQR) values are presented for non-normal distributed data. Values were compared using the nonparametric tests Kruskal–Wallis and Mann–Whitney.

The Kaplan–Meier method was used to estimate the cumulative probability of discharge over time, according to PG – SGA, NRS – 2002 and HGS tertiles. Patients who deceased (3.1%,  $n = 4$ ) were censored at the time of death and those with a length of stay over 30 days were censored at 30 days (13.8%,  $n = 18$ ). Less than 20% of cases had a length of stay  $>30$  days and it could reflect exceptional situations, e.g. a longer length of stay as a result of complications of hospitalization. In addition, a 30-day cutoff has been the previously

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