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ORIGINAL ARTICLE

Nutritional risk associated with mortality in cancer patients admitted to an intensive care unit: A descriptive study of a single center.

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Abstract

Introduction: Critically ill patients with oncological diseases develop a severe metabolic response to aggression with a high degree of hypermetabolism, which constitutes an associated risk and affects the mortality of these patients. The objective of the present study was to measure the nutritional status of a group of cancer patients admitted to intensive care and establish an association with mortality.

Methodology: This retrospective observational study was conducted in the intensive care unit of the National Oncology Institute "Dr. Juan Tanca Marengo" - Guayaquil in September - 2017 / August -2018. The sample was nonprobabilistic of patients with a cancer diagnosis. The variables were age, sex, mortality, NUTRIC score, admission condition, type of tumor, APACHE and SOFA physiological scales, days of hospitalization, and some comorbidities. ROC curve, Spearman's Rho, and Chi^2 analyses were used to establish the association.

Results: A total of 176 cases were included, aged 57 years (IR 43-67). 113/176 women (64.2%). The mean APACHE score was 18 ±7.3, and the median SOFA score was 4.0 (IR 1.0 – 6.0). The most frequent type of cancer was gynecological, with 25% (44/176) of cases. Mortality was 19.9% (35/176). NUTRIC scores were higher in deceased patients [Me 6.00 (IR 5-9) vs Me 3.00 (IR 1-4); P<0.0001]. The presence of a NUTRIC score >4 has a sensitivity of 74.3% (95% CI 56.7 – 87.5), a specificity of 80.9% (95% CI 73.4 – 87.0), a positive predictive value of 49.1% (95% CI 39.4 – 58.7) and a negative predictive value of 92.7% (95% CI 87.8 – 95.7) for the outcome of mortality.

Conclusion: In this study, high modified NUTRIC score scores were strongly associated with mortality in critical cancer patients. High scores on the modified NUTRIC score test correlate with worse clinical condition at admission and more extended stay in the intensive care unit.

Keywords:
DeCS: Malnutrition; Neoplasms; Health Status Indicators; Critical Care; Nutritional and Metabolic Diseases.

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Introduction

Critically ill patients develop a severe metabolic response to aggression, increasing caloric expenditure by carbohydrate mobilization, lipid deposition, and protein catabolism, resulting in weight loss in hospitalized patients [1]. This metabolic stress aims to ensure sufficient levels of circulating substrates in the absence of intake. However, it leads to the appearance of a series of disorders depending on its duration and intensity, which leads to a greater risk of malnutrition, increasing its percentage. If patients suffer from a chronic basal deterioration process such as cancer-associated anorexia [2], early identification of patients with nutritional risk is essential.

Oncological disease conditions a high degree of hypermetabolism, characterized by a deficit in nutritional intake and abnormal utilization of nutrients. Nutritional support in this type of patient must be early and specific, especially if it is administered enterally, to stop the hypercatabolic response and reduce malnutrition and its adverse effects, playing a vital role in the treatment and recovery of critical cancer patients [3].

All patients admitted to the ICU should have a nutritional evaluation and, if possible, receive nutrition within the first 24 to 48 hours of admission. However, in this type of critical patient, the classic nutritional assessment variables (body mass index, weight loss, food intake) are not reliable [4], for which a conceptual model has been presented of how certain variables can influence the nutritional status at admission to intensive care and impact the patient's evolution. The variables used in this tool were age, physiological APACHE II and SOFA scores, the number of comorbidities, days of hospitalization before ICU admission, and IL-6 levels [5]. In 2016, the American Society for Parenteral and Enteral Nutrition (ASPEN) and the Society of Critical Care Medicine (SCCM) recommended the assessment of nutritional risk with the questionnaire "Nutritional Risk in Critically Ill Score" (NUTRIC score). As there was no information on the nutritional status of cancer patients admitted to intensive care units, this observational study was carried out in a regional reference cancer center in Guayaquil-Ecuador to measure the nutritional status of a group of cancer patients admitted to intensive care. Intensive care and establish an association with mortality.

Materials and methods

Study design

The present study is observational and retrospective.

Study area

The study was conducted in the Oncology Intensive Care Unit of the National Oncology Institute “Dr. Juan Tanca Marengo,” Solca Guayaquil Hospital. The study period was from September 1, 2017, to August 31, 2018.

Universe and sample

The population was made up of all the patients registered in the institution. The sample size calculation was nonprobabilistic, census type, in which all incident cases in the study period that met the admission criteria were included.

Participants

Cases of patients hospitalized in oncology intensive care aged 18 years or older were included. Cases of patients with cancer diagnoses were included. Patients who were discharged or died within the first 24 hours of intensive care admission were excluded from the study. Additionally, cases with incomplete records were excluded from the analysis.

Variables

The variables were age, sex, mortality, NUTRIC score, admission status, and type of tumors. Additionally, the APACHE and SOFA physiological scales, the days of hospitalization in the ICU, and the number of comorbidities were recorded.

Procedures, techniques and instruments.

The data were collected from the clinical history in a form designed exclusively for this purpose. The institutional electronic system and the intensive care unit records were used to investigate cases.

Bias avoidance

To guarantee the reliability of the information, the researchers were trained in data collection. A double checklist was used to include all possible cases. The principal investigator validated and curated the data: Carlos García Cruz, head of the intensive care department.

Statistical analysis

Descriptive and inferential statistics were used. Continuous variables were expressed as the means ± standard deviation (SD) for normal distributions and as the median (l) and interquartile range (IR) for nonnormal distributions; categorical variables were expressed as frequencies and percentages. The chi-square test for association was used to analyze qualitative variables, and Student's t-test or the Mann-Whitney U test, as appropriate, was used to analyze quantitative variables. A value of $P < 0.05$ was considered significant. Binomial logistic regression, ROC curve analysis, and Spearman's Rho were used to evaluate the discriminatory capacity of the modified NUTRIC score and the association for selected outcomes. Statistical analysis was performed under the MedCalc Statistical Software version 18.2.1 environment.

Results

Study participants

The study included 176 analyzable cases (Figure 1).

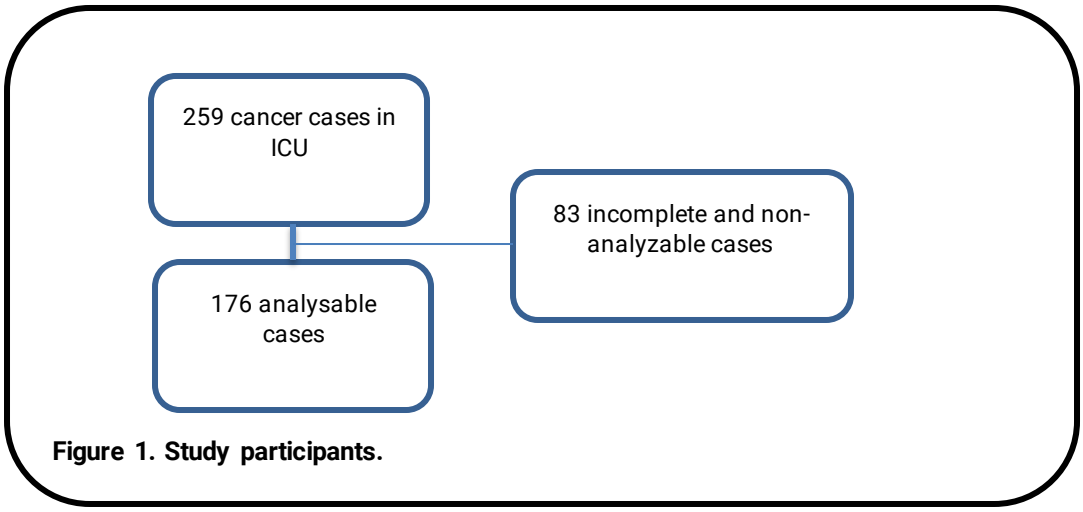

Figure 1. Study participants.

Characteristics of the participants

Participants had a median age of 57 years (IR 43-67). A total of 113/176 cases were women (64.2%), and 63/176 cases (35.8%) were men. The mean APACHE score was 18 ± 7.30 SD, and the median SOFA score was 4.0 (IR 1.0 – 6.0). A total of 39.8% (70/176) of the patients had two or more comorbidities associated with their oncological diagnosis. The most frequent type of cancer was gynecological, with 25% (44/176) of cases. Other characteristics of the patients are detailed in Table 1.

Table 1. Descriptive variables of the study group.

Variable	Statistical
Age (Me, RI)	57 (43-67)
Sex(%n)	♂ 64.2% (113/176) ♀ 35.8% (63/176)
Hospitalization days prior to ICU (Me, RI)	0 - < 1: 20% (35/176) ≥1: 80% (141/176)
APACHE (X ± SD) SOFA (Me, RI)	18.61 ± 7.30 4 (1.0 – 6.0)
Comorbidities (%n)	0 - 1: 60.2% (106/176) ≥ 2: 39.8% (70/176)
Type of cancer(%n)	Gynecological 25.0% (44/176) Nervous System 22.2% (39/176) Digestive 14.8% (26/175) Hematologic 14.2% (25/176) Urological 6.8% (12/176) Endocrinology 5.7% (10/176) Musculoskeletal 5.1% (9/176) Respiratory 4.0% (7/176) Skin 2.3% (4/176)

Me: Median, RI: Interquartile range, X: Mean, SD: Standard deviation.

Nutritional status of study participants

The median of the NUTRIC test was 3.0 (IR 1.5 – 5.0). Low scores (0 - 4) were found in 123/176 patients (69.9%), and high scores (5 - 9) were found in 53/176 patients (30.15%). There were differences in the characteristics of the patients regarding the low and high scores of the NUTRIC score, the same ones that are detailed in the Table 2.

Table 2. Patient Characteristics According to Low or High NUTRIC Score Groups..

	MODIFIED NUTRIC SCORE		
Variable	Low (0-4)	High (5-9)	*P*
Sex♀/♂	67.3% / 74.6%	32.17% / 25.4%	0.3098
Age (Me,IR)	52 (40-65)	61 (53-72)	0.0007
APACHE (x±sd)	14.71 ± 5.20	25.62 ± 5.60	<0.0001
SOFA (Me,RI)	2 (0-4)	8 (6-11)	<0.0001
Days prior to ICU (Me, RI)	1 (1-2)	2 (1-6)	0.0120
Comorbidities	79.2%	20.8%	0.0009

Me: Median, RI: Interquartile Range, X: Mean, SD: Standard Deviation.

Mortality

Mortality was 19.9% (35/176). NUTRIC score scores were significantly higher in deceased patients than in living patients at the end of their ICU stay [Me 6.00 (RI 5-9) vs. Me 3.00 (RI 1-4); P < 0.0001] (Figure 2). A higher proportion of low modified NUTRIC scores was found when the outcome was not fatal (92.7% vs. 7.3%, P < 0.0001) (Figure 3).

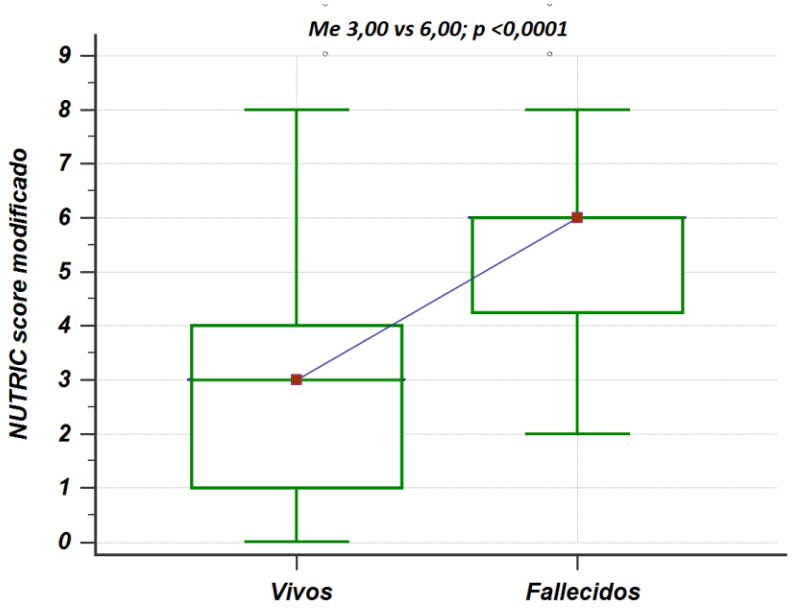

Figure 2. Modified NUTRIC score according to condition at ICU discharge.

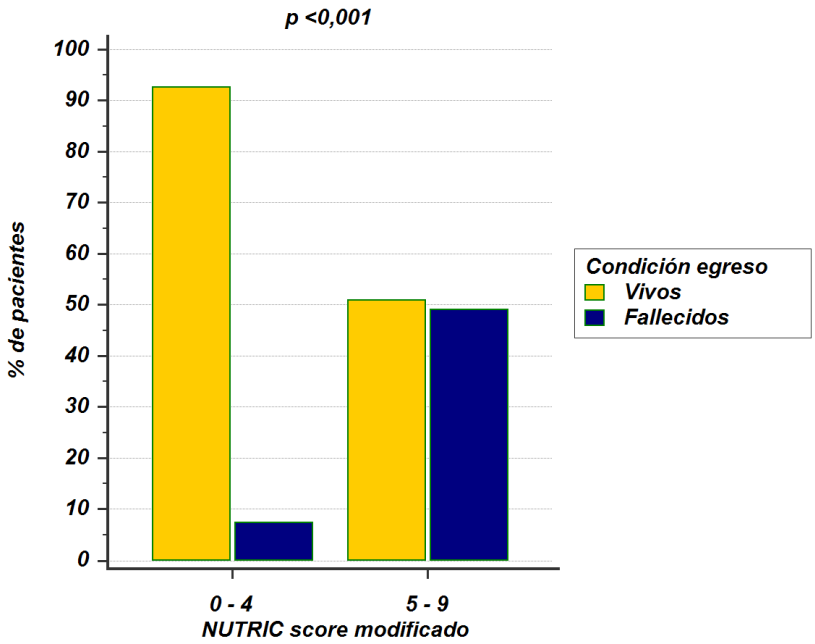

Figure 3. Contingency between condition at ICU discharge and modified NUTRIC score.

Diagnostic tests

ROC curve analysis confirmed the analytical relationship between the NUTRIC score and mortality (AUC 0.816; 95% CI 0.751 – 0.870; P <0.0001) (Figure 4). The presence of a NUTRIC score >4 has a sensitivity of 74.3% (95% CI 56.7 – 87.5), a specificity of 80.9% (95% CI 73.4 – 87.0), and a positive predictive value (PPV) of 49.1% (95% CI 39.4). – 58.7) and a negative predictive value of 92.7% (95% CI 87.8 – 95.7) for the mortality outcome.

Association analysis

There was a moderately significant positive correlation between modified NUTRIC score scores and days of hospitalization (Spearman's Rho 0.401; P < 0.0001). (Figure 5). Statistically significant differences were found in the modified NUTRIC score according to the type of admission, whether due to clinical or surgical conditions (Me 4.0 IR 2-6 vs. Me 2 IR 1-3; P=0.0001). No significant differences were found in the modified NUTRIC score according to the type of tumor, solid or hematological (Me 3.0 IR 1-5 vs. Me 3.0 IR 2.75-5; P = 0.168).

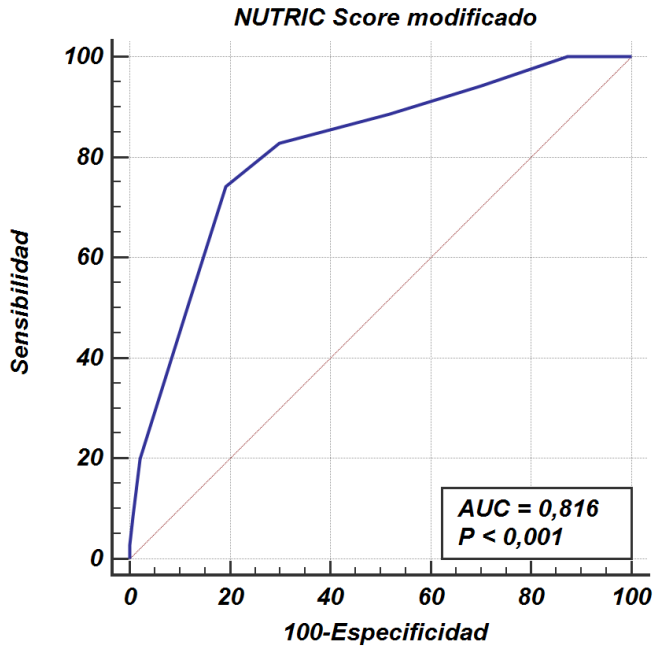

Figure 4. ROC curve analysis of the modified NUTRIC score for the mortality outcome.

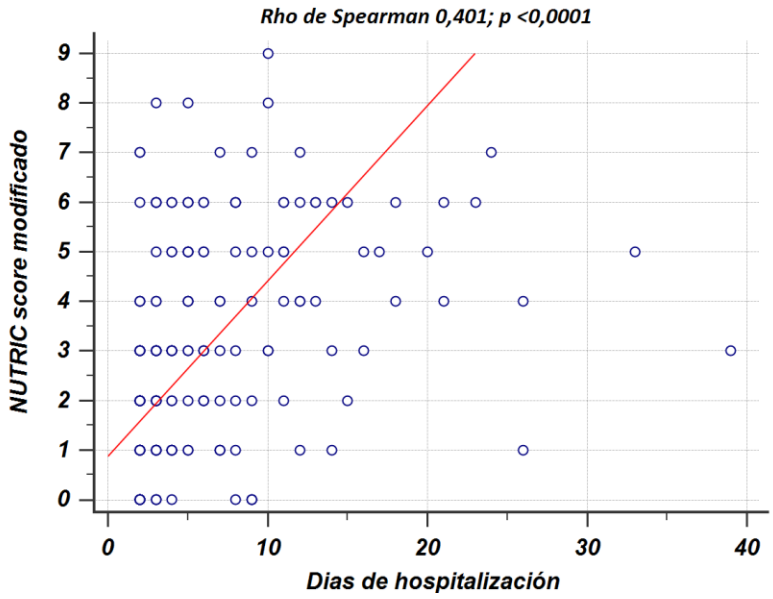

Figure 5. Correlation between modified NUTRIC score and days of hospitalization.

Discussion

In the present study, the mean age corresponds to 57 years of age, a relatively young population, which contrasts with nutritional studies carried out in Asia, where Yun Tae Jung et al. in a population of 1118 critical post-surgical abdominal surgery patients, the mean age was 71 years, and Dae Hyun Jeong et al., in a sample of 518 critically ill septic patients, the mean age was 63 years [6]. In this study, the frequency of cases in women was 64.2%, similar to the survey by Dae Hyun Jeong [6], and the population of this study is critical cancer patients, which coincides with the work report for the years 2016-2018 of the SOLCA-Guayaquil Institution, where the incidence by sex corresponds to 63% for women and 40% for men. Cases are found in the age group of 45 – 64 years of age [7].

In this study, most ICU admissions correspond to patients at low risk of severity with an average APACHE of 18 and SOFA of 4, contrasted with cohorts of patients with a large APACHE scale, prolonged hospitalization time, and advanced age [4].

In the present study, 30.15% of cancer patients admitted to the ICU were at nutritional risk (NUTRIC score ≥5); this finding is much lower than that reported with this same questionnaire by a Portuguese study [8], where it is said that 48.6% of the patients had a high nutritional risk. The median modified NUTRIC score in this study was 3.0, which was lower than that in the original NUTRIC score validation study [4, 7]. This could be due to the younger age of the study patients (57 vs. 65.0 years), APACHE II (18 vs. 23), and SOFA (4 vs. 7) [3].

The present study's mortality was 19.9% (35/176), which differs from other studies of similar designs, whose reports range from 29%, 31%, and 53% [5, 9, 10].

NUTRIC score scores were significantly higher in deceased patients than in living patients at the end of their ICU stay, consistent with a previous report [8]. The presence of a NUTRIC score >4 has a sensitivity of 74.3%, a specificity of 80.9%, a PPV of 49.1%, and a negative predictive value of 92.7% for the outcome of mortality. In the study by MS Kalaiselvan et al., the mortality outcome was a score ≥5 [9].

In the present cohort, a positive relationship between the modified NUTRIC score and the days of hospitalization was demonstrated. These data are similar to those of the study by Heyland et al., which showed that high NUTRIC scores were associated with more significant days of mechanical ventilation [3].

In the present study, most ICU admissions were patients in need of clinical treatment, and patients with surgical treatment were the minority. In the Dino Moretti et al. study, clinical admissions corresponded to 62% of the survivors [10].

There was no difference in the nutritional risk between patients with solid or hematological tumors in the present study, and the median was 3. The most frequent type of oncological pathology was gynecological neoplasia with 25%, followed by tumors of the nervous, digestive and abdominal systems, which coincides with the Institute of SOLCA-Guayaquil 2017 report were breast and cervical cancer are the cancers with the highest incidence in females [7].

Considering the simplicity, reliability, and reproducibility of the modified NUTRIC test, we think its use as a routine method in intensive care units is advisable. It is suggested that all cancer patients have continuous nutritional assessment during their treatment, which would prevent individuals with high dietary risk from being caught early. It is recommended that critical cancer patients with a modified NUTRIC score of 4 be considered at high nutritional risk

and benefit from early dietary intervention based on the ROC curve data obtained in this study. Future prospective studies should address this topic.

Conclusions

In this study, high modified NUTRIC score scores were strongly associated with mortality in critical cancer patients. High scores on the modified NUTRIC score test correlate with worse clinical condition at admission and more extended stay in the intensive care unit. There were no differences in the nutritional risk between patients with solid and hematological tumors.

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Abbreviations

NUTRIC: NUTRITION Risk in the Critically ill.

Administrative information

Additional Files

None declared by the authors.

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Author contributions

Cynthia Katiuska Bajaña Huilcapi: conceptualization, validation, visualization, methodology, project management, writing: review and editing.

Galo Leonardo Martinez Rodríguez: conceptualization, data curation, formal analysis, fundraising, research, resources, software, writing - original draft.

Carlos García Gruz: conceptualization, data curation, formal analysis, fundraising, research, resources, software.

All authors read and approved the final version of the manuscript.

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Availability of data and materials

Data availability is available upon request to the corresponding author. No other materials reported.

Statements

Ethics committee approval

It does not apply to observational studies with a review of databases or medical records.

Consent to publication

Does not apply to studies that do not publish explicit images such as CT scans, MRIs, physical exam images.

Conflicts of interest

The authors declare that they have no conflict of interest or competence.

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