European Geriatric Medicine 7 (2016) 13–17

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Research paper

Association of "Controlling Nutritional Status Index" and "Prognostic Nutritional Index" with intensive care unit survival in elderly patients

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ARTICLE INFO

Article history:
Received 29 April 2015
Accepted 31 July 2015
Available online 28 August 2015

Keywords:
Intensive Care Unit
Elderly patient
Nutritional Index
Survival

ABSTRACT

Objectives: Providing proper nutritional support for the intensive care unit (ICU) patients is only possible with assessment of malnutrition. In this study, we aimed to evaluate associations between nutritional indexes which were developed to assess malnutrition using blood parameters, and survival among elderly patients in the ICU.

Patients and methods: Patients older than 65 years of age and monitored in the ICU, were retrospectively screened with nutritional indexes in order to assess the nutritional status. Each patient was evaluated with both "Controlling Nutritional Status Index" (CONUT) which includes albumin, total cholesterol, total lymphocyte counts, and "Prognostic Nutritional Index" (PNI) which includes only albumin beside total lymphocyte count.

Results: Two hundred twenty five patients were enrolled in this study. Median age was 79 (range: 65–100). One hundred and eleven (49.3%) patients died during intensive care follow-up. CONUT and PNI scores displayed significant differences between patients who died and who were discharged ($P = 0.02$ and $P = 0.03$, respectively). Kaplan–Meier analysis revealed that high CONUT (≥ 5) and low PNI (<40) scores were associated with intensive care unit survival but statistical significance was not provided for PNI ($P = 0.04$ and $P = 0.06$, respectively).

Conclusion: Both CONUT and PNI indexes seems associated with survival but only CONUT score provides statistically significant prognostic information and may serve as a cost-effective nutritional assessment tool in elderly patients. Because this association did not retain its significance on multivariate analysis, the validity of this index in elderly patients should be further evaluated by prospective studies including larger samples.

1. Introduction

Nutritional support plays a vital role in patients admitted to the intensive care unit (ICU) due to various reasons. Losing body mass leads delayed functional recovery after discharge, and reduces the survival rate [1]. Therefore, nutritional status should be carefully assessed with proper tools. A consensus issued by the Academy of Nutrition and Dietetics (AND) and American Society for Parenteral and Enteral Nutrition (ASPEN) underscores the importance of inflammation in malnourished adults [2]. In this consensus, malnutrition was defined as the presence of 2 or more of the six (insufficient energy intake, weight loss, loss of muscle mass, loss of subcutaneous fat, localized or generalized fluid accumulation that may sometimes mask weight loss and diminished functional status as measured by hand grip strength) predetermined components [2]. There is no special consensus recommendation for the ICU patients or the elderly patient group.

Several indexes have been used to determine the nutritional status of ICU patients [3]. One of them is the "NUTrition Risk in Critically ill (NUTRIC) Score", which includes age, number of comorbidities, days from hospital to ICU admission, acute physiology and chronic health evaluation II (APACHE II) and Sequential Organ Failure Assessment (SOFA) Scores. NUTRİC score can be calculated with or without interleukin (IL)-6 values [4]. Subjective Global Assessment (SGA) comprises evaluation of the following: current weight, weight before illness and weight

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http://dx.doi.org/10.1016/j.eurger.2015.07.007
1878-7649/

change in the previous six months and in the last 15 days; nutritional history (appetite, diet intake, gastrointestinal symptoms); gastrointestinal derangements (diarrhea, vomiting, nausea); functional physical capacity; and finally, physical assessment (fat loss, edema, muscle wasting and ascites) [5]. However, in the ICU environment where patients are admitted in acute conditions, it is often not possible to gain information from the patient or the relatives, and generally it is not easy to perform anthropometric measurements. Therefore, simple and repeatable assessment indexes prove to be more convenient and practical in gaining information about the prognosis of such patients.

Controlling Nutritional Status Index (CONUT) and Prognostic Nutritional Index (PNI) are formulas that allow easy and rapid assessment of nutritional status [6,7]. While CONUT evaluates albumin, total cholesterol (TC) and total lymphocyte values, PNI measures only albumin levels and total lymphocyte count. Generally, PNI has been used to assess the nutritional status of cancer patients [7–9]. Some studies indicate the prognostic importance of PNI in various cancer groups [10]. Recently, PNI has been studied with regard to its efficacy in the assessment of nutritional status in chronic liver and kidney diseases, as well as its prognostic importance [11,12]. CONUT is a relatively new index and its efficacy has been lately started to be evaluated [6]. There are studies particularly involving patients with chronic heart failure and chronic liver disease [11,13]. To our knowledge, there is no data in the literature regarding the employment of these indexes in nutritional assessment of intensive care patients.

In this study, we aimed to assess the nutritional status of elderly (aged ≥65 years) ICU patients using CONUT and PNI scores, and investigate any relationship between these scores and ICU-survival.

2. Patients and methods

Our institution which serves as an academic medical center includes a medical, a surgical, a cardiovascular and a cardiology ICUs. Patients are accepted to medical ICU primarily from internal medicine, neurology and pulmonology services but patients candidate for other ICUs are also accepted when these other ICUs have a shortage of bed. A total of 748 patients followed in the medical ICU between January 2011 and December 2013 were screened. Three hundred one patients who were under 65 years old were excluded and 447 (59.7%) patients of 65 years or older were included. The demographic features, clinic characteristics, and laboratory data of the patients were investigated by using the hospital automation system and file archive system After this investigation, 222 patients whose file information was missing or inaccessible were also excluded and a total of 225 patients complying with the inclusion criteria were evaluated. The total lymphocyte, albumin, total cholesterol levels of patients before received any treatment, intensive care unit admission time, were recorded. CONUT was calculated and classified according to the study of Ignacio de Ulíbarri et al. [6]. (Table 1). PNI was calculated as Onodera et al. was first described with the following formula: 10 × serum albumin value (g/dl) + 0.005 × peripheral lymphocyte count (per mm^3) [7]. In the original study; the patients were divided into 3 groups based on the initial PNI score: malnutrition (PNI < 40), mild malnutrition (PNI = 40–45), and non-malnutrition (PNI > 45) [7]. When we grouped patients like in original study, 161 (71.6%) patients were in PNI < 40 group, 37 (16.4%) patients were in PNI = 40–45 group and only 27 (12.0%) patients were in PNI > 45 group. In order to perform further statistical analysis, we had to simplify groups as "severe malnutrition (PNI < 40)" and "mild or no malnutrition (PNI ≥ 40)". Comorbidities of the patients were evaluated with 19 disease-weighted Charlson Comorbidity Index (CCI) [14].

Table 1
Assessment of malnutrition by Controlling Nutritional Status Index.

Parameters	Malnutrition degree			
	Normal	Mild	Moderate	Severe
Albumin (g/dL) Score	≥3.50	3.00–3.49	2.50–2.99	<2.50
	0	2	4	6
Total lymphocyte	≥1600	1200–1599	800–1199	<800
(/mL) score	0	1	2	3
Total cholesterol	≥180	140–179	100–139	<100
(mg/dL) score	0	1	2	3
Total score	0–1	2–4	5–8	9–12

3. Statistical analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences software program version 15.0 (SPSS Inc., Chicago, IL, USA). Non-parametric variables were expressed as median (range) and were compared using the Mann-Whitney or Kruskal-Wallis. Categorical variables were expressed as counts and percentages. Chi-squared or Fisher exact tests were used for comparative analysis of categorical data. The duration of survival in the Intensive Care Unit (ICU-survival) was calculated from date of admitted in intensive care unit and the death or until the discharge date. ICU-survival was estimated using the Kaplan-Meier method and the log-rank test was used for comparison of outcomes. A Cox regression model was used to analyze independent prognostic risk factors. A P-value < 0.05 was considered statistically significant.

4. Results

In our study, a total of 225 patients complying with the inclusion criteria were evaluated. The median age was 79 years (range: 65-100) and 107 (47.6%) patients were above 80 years of age. Nearly half of the patients (50.7%) were female. One hundred fifty-nine (70.7%) patients were intubated or received mechanical ventilation in intensive care unit. Median mechanically ventilated or intubated stay time was 24 hours (range: 1–960 hours). According to CONUT, 70.3% of patients were considered malnourished (46.7% moderate and 27.6% severe). PNI revealed that 71.6% had severe malnutrition. The general characteristics and values of both scores (CONUT and PNI) of the patients are shown in Table 2.

Median duration of staying in intensive care unit was 5 days (range: 0–163). One hundred and eleven patients (49.3%) died during intensive care follow-up. Among all patients, 159 patients (70.7%) were followed mechanically ventilated or intubated. Patients were divided into two groups according to their condition of leaving ICU as "discharged alive" (n = 114) and "died in ICU" (n = 111). The characteristics of these groups were shown in Table 3. The mechanical ventilation/intubation rate and CCI score were significantly higher in patients who died in the ICU (P < 0.0001 and P = 0.002, respectively). One hundred and three of all 111 patients (92.8%) who died in ICU had been followed mechanically ventilated or intubated. CONUT and PNI scores also displayed significant differences between patients who died in ICU and who were discharged (P = 0.02 and P = 0.03, respectively). Median ICU-survival was 34.0 (95% CI 19.6–48.3) days for the patients with low CONUT score (0–4) and 18.0 (95% CI 9.2–26.7) days for those with high CONUT score (≥5) (P = 0.04). Median ICU-survival was 18.0 (95% CI 8.7–27.3) days for the patients with low PNI (<40) and 26.0 (95% CI 12.5–33.5) days for those with high PNI (≥40).,The Kaplan-Meier analysis showed 8 days of survival difference between the PNI groups, however, the difference was not statistically significant