RESEARCH

RELATIONSHIP BETWEEN DIFFERENT NUTRITIONAL SCORES IN ELDERLY PATIENTS WITH ACUTE DECOMPENSATED HEART FAILURE IN THE CORONARY INTENSIVE CARE UNIT

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Abstract

Introduction: The relationship between heart failure and malnutrition is significant. The most commonly used nutritional indices are theprognostic nutritional index, controlling nutritional status, and albumin–bilirubin grade. We aimed to investigate the clinical impact of nutritional status in elderly acute decompensated heart failure patients and the relationship between the prognostic nutritional index, controlling nutritional status, and albumin–bilirubin grade nutritional indices to detect 12-month and 3-month rehospitalization rates, mortality, and length of stay in the Coronary Intensive Care Unit. Our study is the first to evaluate the controlling nutritional status and albumin–bilirubin grade in our study cohort in Turkey.

Materials and Methods: The medical records of 1162 patients hospitalized in the Coronary Intensive Care Unit were evaluated retrospectively. A total of 123 patients were included.

Results: We found a statistically significant difference between the prognostic nutritional index, albumin–bilirubin grade and controlling nutritional status scores and mortality. However, the most statistically significant relationship was found in the prognostic nutritional index score. We found that as the nutritional scores worsened, the length of hospital stay was prolonged. The albumin–bilirubin grade score in the short term and controlling nutritional status score in the long term were not statistically significant to show rehospitalization.

Conclusion: Prognostic nutritional index is an independent predictor of mortality, short- and long-term rehospitalizations, and length of stay in elderly patients with acute decompensated heartfailure. Its predictive power was better than the albumin–bilirubin grade and controlling nutritional status scores evaluated in our study.

Keywords: Heart Failure; Malnutrition; Aged; Coronary Care Unit; Nutritional Status.

INTRODUCTION

Malnutrition is becoming a growing health problem in elderly patients and is associated with increased mortality and morbidity in several clinical conditions (1–3). According to a recent scientific statement from the American Heart Association, the prevalence of malnutrition in patients admitted to the CICU can be as high as 78% in critically ill patients (4).

There is a complex relationship between heart failure (HF) and malnutrition. Malnutrition may worsen functional capacity and renal function and may increase susceptibility to infections. On the other hand, worsening HF may cause malnutrition and even cachexia (5).

The prevalence of malnutrition was 46% in a recent meta-analysis of HF patients. Moreover, it showed that the all-cause mortality of patients with malnutrition was almost twice that of non-malnutrition patients with HF (6). In another study that evaluated the nutritional status of intensive care patients, the prevalence of malnutrition was found to be as high as 47.6% upon admission (7).

The most commonly used nutritional indices are the prognostic nutritional index (PNI), controlling nutritional status (CONUT), and albumin–bilirubin grade (ALBI). Previous studies have shown that these nutritional indices are associated with prolonged hospital stay, readmission, and all-cause mortality in patients with cardiac and non-cardiac conditions (8–11).

The PNI is especially designed to assess perioperative surgical risk in patients with cancer. Previous studies showed an increased mortality risk in HF patients with a decreased PNI. However, the prognostic impact of PNI remains uncertain in elderly patients with acute HF in cardiac intensive care units (CICU) (8,12,13).

The CONUT score is derived from the values of serum albumin concentration, peripheral blood total lymphocyte counts, and total cholesterol levels. Higher CONUT scores show worse nutritional status and are associated with worse clinical outcomes (14–16).

The relationship between serum albumin levels and nutritional status is well known, and ALBI seems to be a new indicator of mortality and prognosis for heart failure patients in limited studies (17–19).

Although there is growing interest in the assessment and treatment of malnutrition, specific standardized assessments and treatment protocols are still lacking for CICU patients. Different nutritional indices are evaluated in different patient populations (12,20–22).

Therefore, we aimed to investigate the clinical impact of nutritional status in elderly acute decompensated HF patients and the relationship between the PNI, CONUT, and ALBI nutritional indices to detect 12-month (RH12M-long term) and 3-month (RH3M-short term) rehospitalization rates, mortality, and length of CICU stay.

MATERIALS AND METHODS

Study population

This was a single-center retrospective study. The medical records of 1,162 patients admitted to our CICU between January 2019 and January 2021 were evaluated retrospectively. Patients older than 65 years old and hospitalized with acute decompensated heart failure were included in the study.

Patients with acute coronary syndrome, severe liver cirrhosis (Child–Pugh score B or C), sepsis, malignancy, or elective hospitalizations, such as electrical cardioversion, pacemaker replacement, or implantation and heart transplantation recipients, were excluded.

Patients with missing laboratory data, insufficient medical records, or loss during follow-up were also excluded.

A total of 123 patients were included in the study.

The baseline characteristics, co-morbidities, and laboratory and echocardiographic parameters were noted.

The research protocol was approved by the Başkent University Institutional Review Board (Project no:KA21/44)

Assessment of Nutritional Status:

Nutritional indices were calculated from the first 24 hours' blood sample results.

The PNI value was calculated according to the following formula– 10x serum albumin (g/dL) + 0.005 × total lymphocyte count (mm3).

The CONUT score was calculated using the following equation:

Serum albumin [g/dL] + total lymphocyte count [mm3] + total cholesterol [mg/dL].

The ALBI grade was calculated using the following formula:

ALBI = (log10 bilirubin (μmol/L) × 0.66) + (albumin (g/L) × −0.085).

Assessment of end points

The rehospitalization rates, mortality, and length of CICU stay were evaluated using our hospital's medical record database. All the patients were also contacted via telephoning to exclude possible hospitalizationsin other hospitals.

Statistical analysis

The data were analyzed using SPSS 21.0 (IBM Corporation, Armonk, NY, USA) software. The data were expressed as mean ± standard deviation and median (range) for continuous variables and percentage for categorical variables. The CONUT, PNI and ALBI scores were the continuous variables. When we evaluated the continuous variables, CONUT and PNI showed skewed distribution, while ALBI showed normal distribution. The normally distributed data were analyzed by a t-test and the variables that did not show normal distribution were compared using Spearman's rank correlation and Mann–Whitney U tests. A p value of <0.05 was considered statistically significant.

RESULTS

We assessed nutritional status at admission using three indices to estimate the clinical impact on elderly patients in the CICU.A total of 123 patients were included in the study.

The mean age was 76.3 years. The demographic and clinical properties of the study population are shown in Table 1.

The median PNI, CONUT, and ALBI scores were 116±81.5, 3.4±2.1, and -2.32±0.37, respectively.

We defined all-cause mortality in 17.1% (21) of the patients during a median follow-up duration of 12±9 months.

The median length of CICU stay (LOS) was 6 days. We showed a statistically significant correlation between LOS and all nutritional scores. Longer LOS was correlated with worse nutritional status (Table 2).

Relationship between the length of stay of the patients and the PNI, ALBI, and CONUT scores

The PNI score was inversely correlated with LOS(p=0.02). A positive and low-level significant correlation was found between the LOS and ALBI scores (p=0.014). A positive and significant correlation was found between the LOS and CONUT score measurements (p=0.003). The length of the CICU stay decreased as patients' PNI scores increased (negative correlation), and the LOS increased as CONUT / ALBI scores increased (positive correlation) (Table 2).

Relationship between mortality and the PNI, ALBI, and CONUT scores

We showed a statistically significant difference between the PNI, ALBI, and CONUT scores and

Table 1. Demographic and clinical properties of the study population

Variables	Total (n=123)
Age (years, mean ±SD)	78.2± 9
Men, n (%)	66 (55.9)
Hypertension, n (%)	69 (58.5)
Diabetes Mellitus, n (%)	46 (39)
Coronary artery disease, n (%)	69 (58.5)
Stroke /TIA, n (%)	13 (11)
AF /PAF, n (%)	64 (54.2)
Hemoglobin, mg/dL	12±2
Plateletcount, 10^9/L	218.6±80
White blood cell count, 10^9/L	10.7 ±24.5
Creatinine, mg/dL	1.3±0.5
AST (U/L)	25.8±15.3
ALT (U/L)	22.4±17.8
Albumin, g/dL	3.64±0.4
HDL cholesterol, mg/dL	43.5±13
LDL cholesterol, mg/dL	86.2±30
Triglyceride, mg/dL	101.8±49
LVEF, %	38.5±14
TAPSE	16.1±4
SPAB, mmHg	49.5±17
ASA, n (%)	53 (43.1%)
β-Blocker, n (%)	86 (69.9%)
Clopidogrel, n (%)	20 (16.3%)
RAS inhibitors, n (%)	65 (52.8%)
Diuretics, n (%)	121 (98.4%)
Inotrops, n (%)	13 (10.6%)

SD (Standard deviation), TIA: transient ischemic attack, AF: atrial fibrillation, PAF: paroxysmal atrial fibrillation, AST: aspartate transaminase, ALT: alanine transaminase, HDL: high-density lipoprotein, LDL low-density lipoprotein , LVEF: left ventricular ejection fraction, TAPSE: transannular systolic excursion, SPAB: systolic pulmonary artery pressure calculated by echocardiography, ASA: acetylsalicylic acid, RAS: renin–angiotensin system (RAS inhibitors include angiotensin-converting enzyme inhibitor or angiotensin receptor blockade)

Table 2. The relationship between the length of stay and the PNI, ALBI and CONUT scores.

		PNI score	ALBI score	CONUT score
LOS (day)	r	-,215	,246	,291
	p	,020*	,014*	,003**
	N	118	99	103

p<0.05*, p<0.01**, LOS: the length of CICU stay

Table 3. Relationship between mortality and PNI, ALBI and CONUT scores.

	Mortality -/+	N	mean	SD	p
PNI	-	21	82,36	22,68	,001**
	+	97	121,17	88,36	
ALBI	-	17	-2,15	0,42	,019*
	+	82	-2,37	0,34	
CONUT	-	18	5,11	2,56	,002**
	+	85	3,11	1,94	

p<0.05*, p<0.01**, SD: standard deviation, PNI: the prognostic nutritional index, CONUT: the Controlling Nutritional status, ALBI:the albumin–bilirubin grade, -: ex, +: survive

mortality. As shown in Table 3, the CONUT and PNI scores were better in the patients who survived.

Relationship between the PNI, ALBI, and CONUT scores according to the rehospitalization in first 3 months (RH3M)

A significant difference was found between the PNI and CONUT scores according to the rehospitalization in the first 3 months. The difference between the PNI and CONUT scores of patients with and without rehospitalization in the first 3 months was statistically significant (Table 4). However, there was no significant difference between the ALBI scores according to the rehospitalization in the first 3 months (p>0.05).

Table 4. The relationship between PNI, ALBI and CONUT score according to the RH3M.

	RH3M +/-	N	mean	SD	p
PNI	+	12	78,36	22,96	,002**
	-	106	118,33	85,24	
ALBI	+	12	-2,35	0,33	,903
	-	87	-2,33	0,37	
CONUT	+	12	4,75	2,30	,033*
	-	91	3,29	2,13	

p<0.05*, p<0.01**, SD: standard deviation, PNI: the prognostic nutritional index, CONUT: the Controlling Nutritional status, ALBI:the albumin–bilirubin grade, RH3M: the rehospitalization in first 3 months, -: none, +: rehospitalized

Table 5. The relationship between PNI, ALBI and CONUT score according to the RH12M.

	RH12M +/-	N	mean	SD	p
PNI	+	22	88,25	23,07	,013*
	-	96	120,23	89,23	
ALBI	+	20	-2,49	0,36	,039*
	-	79	-2,30	0,36	
CONUT	+	20	3,95	2,50	,442
	-	83	3,34	2,10	

p<0.05*, p<0.01**, SD: standard deviation, PNI: the prognostic nutritional index, CONUT: the Controlling Nutritional status, ALBI:the albumin–bilirubin grade, RH12M: the rehospitalization in first 12 months, -: none, +: rehospitalized

Relationship between the PNI, ALBI, and CONUT scores according to the rehospitalization in the first 12 months (RH12M)

A significant difference was found between the PNI and ALBI scores according to the rehospitalization after the first 12-month follow-up duration (p<0.05). The difference between the PNI and ALBI scores of patients with and without rehospitalization in the first 12 months was statistically significant (Table 5). However, no significant difference was found between the CONUT scores according to the rehospitalization in the first 12 months (p>0.05).

DISCUSSION

The malnutrition can impediment the healing of diseases. The assessment of only one index of malnutrition may not provide adequate information because the nutrition is not a static condition. Our study is a retrospective analysis to evaluate the nutritional status and the relationship between

different nutritional scores in elderly patients hospitalized with acute decompensated HF.

The main results from the study were as follows: First, PNI was an independent predictor of mortality, short-and long-term rehospitalizations, and LOS in elderly patients hospitalized with acute decompensated HF. Second, its predictive power was better than the other nutritional scores of ALBI and CONUT evaluated in our study. Third, our study is the first to evaluate the role of CONUT and ALBI scores in elderly acute decompensated HF patients in Turkey. Previous studies have shown that the PNI score is associated with mortality and prognosis. Consistent with the literature, our results showed that the PNI score strongly impacted rehospitalization rates and mortality rates.

The difference between The CONUT and PNI scores is the total cholesterol. Albumin decreases as a negative acute-phase reactant and the leukocyte count increases as a marker of inflammation. Therefore, we can say that these scores were in balance and that they represent malabsorption and chronic inflammation in heart failure. We also know that, the underlying mechanism is not only the bad nutritional status but also the acute decompensation of heart failure. Liver dysfunction and congestion are common and contribute to mortality, especially in heart failure. Although studies have been conducted to assess the utility of the ALBI score in HF patients, they have mostly evaluated the effect of liver dysfunction on heart failure (18,19). In our study, the relationship between ALBI scores and length of hospitalization, mortality, and long-term rehospitalization was found to be statistically significant.

Keskin et al. reported that PNI was an independent predictor of mortality and poor prognosis in STEMI patients in a younger population (23,24). Our patient cohort consisted of elderly patients with complex comorbidities. However, similar results were obtained in our study. In a recent study in Turkey, the CONUT score was found to be better than the PNI score in predicting mortality in cardiac TX candidate patients. However, patients with acute decompensated HF were excluded, and the population was younger than in our study (25). Additionally, previous studies have generally evaluated single nutritional scores and compared the roles of low and high scores (8,9,20).

The ALBI scores in the short term (RH3M) and the CONUT scores in the long term (RH12M) were not statistically significant in showing rehospitalization. However, the PNI score was found to be the most statistically significant score in showing both. As expected, all were found to be significantly associated with mortality. Furthermore, the most statistically significant relationship was found in the PNI score. These findings highlight the importance of nutritional scores as a rapid assessment tool to determine the nutritional status of elderly patients with acute decompensated HF.

The aim of our study was to compare the superiority of the scores to each other, but we were unable to perform such a subgroup analysis due to the small number of the study population. We believe that our results may help future meta-analyses or clinical studies.

CONCLUSION

Malnutrition and HF have become public health problems due to advanced age and poor prognoses in developed countries. Mortality indicators for elderly patients are constantly being investigated in the aging population. In our study, we showed the importance of the CONUT, PNI, and ALBI scores in predicting mortality, rehospitalization, and LOS in elderly patients with acute decompensated HF. Nutritional status is important to reflect their immune competence and physical condition, which are the components of their general condition. Nevertheless, malnutrition causes some complications in patients with HF, so the assessment of malnutrition is essential in the CICU. We believe

that large randomized studies are needed on this subject.

Limitations

Our study's main limitations were its retrospective design and a single-center study. The size of the study was relatively small and needs to be confirmed in larger multi-center studies. Due to the retrospective design, how nutritional status could be improved or what the impact of the solutions for this is on the mortality and rehospitalization of patients could not be evaluated. Finally, we did not investigate changes in nutritional status after 1 year.

Conflict of interest

The authors declare no conflicts of interest regarding the publication of this manuscript.

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