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GERIATRIC NUTRITIONAL RISK INDEX IS A PREDICTOR OF RECURRENT PERCUTANEOUS CORONARY INTERVENTION IN PATIENTS WITH NON-ST SEGMENT ELEVATION MYOCARDIAL INFARCTION

<i>Aim</i>	To investigate the relationship between malnutrition and follow-up cardiovascular (CV) events in non-ST-segment elevation myocardial infarction (NSTEMI).
<i>Material and methods</i>	A retrospective study was performed on 298 patients with NSTEMI. The baseline geriatric nutritional risk index (GNRI) was calculated at the first visit. The patients were divided into three groups according to the GNRI: >98, no-risk; 92 to ≤98, low risk; 82 to <92, moderate to high (MTH) risk. The study endpoint was a composite of follow-up CV events, including all-cause mortality, non-valvular atrial fibrillation (NVAf), hospitalizations, and need for repeat percutaneous coronary intervention (PCI).
<i>Results</i>	Follow-up data showed that MTH risk group had significantly higher incidence of repeat PCI and all-cause mortality compared to other groups (p<0.001). However, follow-up hospitalizations and NVAf were similar between groups (p>0.05). The mean GNRI was 84.6 in patients needing repeat PCI and 99.8 in patients who did not require repeat PCI (p<0.001). Kaplan Meier survival analysis showed that patients with MTH risk had significantly poorer survival (p<0.001). According to multivariate Cox regression analysis, the MTH risk group (hazard ratio=5.372) was associated with increased mortality.
<i>Conclusion</i>	GNRI value may have a potential role for the prediction of repeat PCI in patients with NSTEMI.
<i>Keywords</i>	Malnutrition; non-ST segment myocardial infarction; recurrent intervention
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Introduction

The global, elderly population (>65 yrs) has gradually increased over the past few decades. Several studies have revealed malnutrition in older people who are at risk of acute and chronic diseases [1]. Malnutrition may increase the risk of illness, prolong hospitalization, and significantly contribute to morbidity and mortality in the elderly [1]. Although malnutrition also has been reported to be associated with a high rate of mortality in patients with heart failure (HF) [2], few studies that evaluated the relationship between malnutrition and various types of cardiovascular (CV) events.

The geriatric nutritional risk index (GNRI), which is calculated using both plasma albumin and body mass index (BMI), is a tool for evaluating nutrition-

related risk [3]. This simple and practical assessment tool might be useful for predicting CV events in HF patients [4]. Malnutrition is also an independent risk factor for mortality, with several reports showing that GNRI correlated with malnutrition and mortality in patients with CV disease, requiring hemodialysis, or with peripheral arterial disease (PAD) [5–7]. These results indicate that GNRI may be a powerful predictor for clinical outcome in various diseases, so it might potentially be used widely in clinical practice.

However, the possible relationship between GNRI and non-ST segment elevation myocardial infarction (NSTEMI) has not been mentioned in the literature. In this study, we evaluated the relationship between GNRI of NSTEMI patients during the follow-up period and:

- 1) mortality,
- 2) development of non-valvular atrial fibrillation (NVAF),
- 3) hospitalization for angina pectoris,
- 4) repeat percutaneous coronary intervention (RPCI).

Material and methods

Study population

Between 1 January 2015 and 31 December 2017, 1523 patients diagnosed with NSTEMI were admitted to our coronary intensive care unit. According to the current European Society of Cardiology (ESC) guideline in this data registry, only 298 patients from the NSTEMI patient group were included in our study in accordance with the criteria [8] listed below. The follow-up period extended until 31 December 2020.

Criteria for inclusion in the study:

- 1) Diagnosis of NSTEMI according to ESC criteria;
- 2) Complete demographic, laboratory, and follow-up data;
- 3) Percutaneous coronary intervention (PCI) performed on at least one responsible coronary vessel;
- 4) Discharged with cure;
- 5) Age between 65 and 90 yrs;
- 6) Left ventricular ejection fraction (LVEF) greater than 50%;
- 7) Normal sinus rhythm and no history of NVAF;
- 8) Having any disease requiring drug usage other than diabetes mellitus (DM), coronary artery disease, and hypertension (HT).

Criteria for exclusion from the study:

- 1) ST elevation, albeit temporarily;
- 2) LVEF <50%;
- 3) If coronary angiography was not planned;
- 4) Medical treatment or surgical decisions without PCI;
- 5) Cardiac surgery following STEMI with or without complications;
- 6) Presence of moderate to severe valvular heart disease;
- 7) History of atrial or ventricular arrhythmias;
- 8) History of electrical ablation;
- 9) Age <65 yrs;
- 10) Chronic liver or chronic kidney disease;
- 11) Presence of active infection;
- 12) Pregnancy.

Data collection

Baseline clinical data were collected for each patient. Patient information collected at discharge included medical history, laboratory test results, echocardiographic findings, prescriptions. These data were recorded in a computer database. Blood hemoglobin, sodium, serum creatinine, plasma brain natriuretic peptide (BNP), albumin, total cholesterol, and C reactive protein

(CRP) were measured. The estimated glomerular filtration rate (eGFR) was calculated using the following formula: $eGFR = 194 \times \text{serum creatinine}^{-1.094} \times \text{age in years}^{-0.287}$ for male patients. The adjusted eGFR value for female patients was calculated using the following formula: $eGFR \text{ female} = eGFR \times 0.739$ [9]. The BMI was calculated as body weight in kilograms divided by the square of the height in meters.

Demographic properties and comorbidities were identified from the patients' hospital records and the physical examination at the time of presentation. We used standard definitions for risk factors, as described in current guidelines. HT was defined as a systolic blood pressure (SBP) ≥ 140 mm Hg, diastolic blood pressure (DBP) ≥ 90 mm Hg, or current use of antihypertensive medication [10]. Diabetes mellitus (DM) was defined as a fasting serum glucose ≥ 126 mg/dl, hemoglobin-A1C $\geq 6.5\%$, or the use of blood glucose-lowering agents [11]. The standards of the American Society of Echocardiography were used for all measurements. Heart failure (HF) was defined as a LVEF below 50% [12]. According to the 2020 ESC current guidelines, those who were diagnosed with NSTEMI and who were discharged after successful PCI performed on at least one coronary vessel formed the study group [8]. The study was approved by the local Institutional Review Board.

Assessment of nutritional status using the GNRI

The GNRI was developed by Bouillanne et al. [3] as a screening tool for malnutrition in a hospital population. In the present study, the GNRI was calculated from serum albumin and BMI obtained at discharge. We adopted Kinugasa's method [13]: $GNRI = 14.89 \times \text{serum albumin (g/dl)} + 41.7 \times (\text{BMI}/22)$. BMI/22 was set to 1 if the patient's BMI/22 was greater than 1.

Grouping of patients

The patients were classified into different risk groups based on their GNRI, according to the classification of Bouillanne et al. [3]:

- 1) GNRI >98, no-risk group;
- 2) GNRI 92 to ≤ 98 , low nutrition-related risk group;
- 3) GNRI 82 to <92, moderate to high (MTH) nutrition-related risk group;
- 4) GNRI <82, high nutrition-related risk group.

The patients were divided into three groups based on the GNRI values because the number of patients with GNRI values <82 was too small to be analyzed: Group I, no-risk group; Group II, low nutrition-related risk group; Group III, MTH nutrition-related risk group.

Follow-up data

The eligible patients were re-evaluated by 6-mo intervals. 1325 patients whose detailed data could not be re-

rievied were excluded from the study. Follow-up data were obtained from the hospital or health center registry, clinical notes, or by telephone surveys conducted by two cardiologists. Complete follow-up was achieved only for 298 patients, including all-cause mortality, NVAf, NSTEMI related hospitalizations, and need for repeat PCI (RPCI). Hospitalization was defined as staying in the hospital ≥ 2 days for anginal symptoms, especially for chest pain.

Statistical analyses

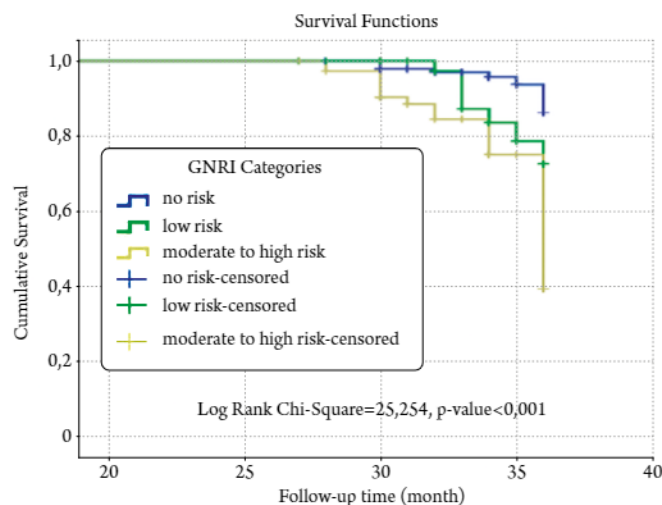
Statistical analyses were carried out using SPSS 23 for Windows (SPSS Inc., Chicago, IL, USA). Normal distribution of data was evaluated by using Shapiro–Wilk test or Kolmogorov–Smirnov test according to sample size. Baseline characteristics are presented as mean \pm standard deviation if normally distributed or as median (quartile deviation) if not normally distributed, and categorical variables are presented as percentages. For analysis of categorical variables, Pearson Chi–Square or Fisher exact test was used. For analysis of continuous variables, Mann–Whitney u, one-way ANOVA or Kruskal–Wallis tests were used, depending on the normality of the data. Kaplan–Meier curves were plotted, and after checking the assumption of proportional hazards, a log-rank test was used to investigate the association between survival and GNRI levels. Additionally, GNRI levels used as predictors in Cox proportional hazard regression and binary logistic regression analyses. Finally, receiver operating characteristic (ROC) analysis was applied to determine the optimal cut-off value of the GNRI associated with RPCI, i.e., having or not RPCI, and mortality with the Youden J index. For all analyses, a two-sided $p < 0.05$ was considered as statistically significant.

Results

The study included approximately 3-yr follow-up data of 298 patients hospitalized for NSTEMI. The patients were classified into risk groups based on their GNRI, as follows: GNRI > 98 , no-risk; GNRI 92 to ≤ 98 , low risk; GNRI 82 to < 92 , MTH risk. Baseline demographic, laboratory, and follow-up findings of the groups are shown in Table 1. No significant differences ($p > 0.05$) were found between the groups in terms of DM, HT, smoking, chronic kidney injury (CKI), history of PCI, or coronary bypass graft surgery (CABG).

Follow-up data showed that the MTH risk group had significantly higher incidence of RPCI compared to patients in low and no risk groups ($p < 0.001$). Also, mortality was significantly higher among patients in the MTH risk group compared to the low and no risk groups ($p < 0.001$). However, number of hospitalizations and follow-up NVAf were similar between groups ($p > 0.05$).

Figure 1. Kaplan–Meier survival curves according to GNRI levels



Participants with moderate to high nutritional risk had a significantly worse survival than Participants with low risk and without nutritional risk.

Patients need for RPCI ($n=46$) or no need for RPCI ($n=252$, $p=0.016$) had similar rates of DM, HT, smoking, CKI, and CABG (Table 2). LVEF were similar between groups ($p > 0.05$). Patients who needed RPCI had significantly lower albumin and BMI values ($p < 0.001$). Other laboratory values were similar ($p > 0.05$). Mean GNRI was 84.6 in those patients needing RPCI patients and 99.8 in patients without RPCI ($p < 0.001$). Patients needing RPCI had significantly higher mortality compared to those patients that did not need RPCI ($p < 0.001$). However, the number of hospitalizations and the follow-up NVAf were similar between patients with and without RPCI ($p > 0.05$).

Kaplan Meier survival analysis, based on GNRI values, showed that patients with MTH risk had significantly poorer survival compared to patients without nutritional risk ($p < 0.001$) (Figure 1). In the multivariate Cox regression analysis, the MTH risk group was associated with increased mortality (hazard ratio (HR) = 5.372, Table 3).

The effects of GNRI, age, sex, chronic diseases, cardiological statements, geriatric conditions on the odds ratio of RPCI were examined by binomial logistic regression analysis with forward variable selection, and only GNRI levels were found to be statistically significant (Table 4). In this analysis, patients with no risk level were set as the reference category. According to Table 4, when the patient was in the MTH risk group, he or she was 28 times more likely to belongs to the RPCI group than belonging to the non- RPCI group. AOC analyses for prediction of need for RPCI and for mortality are shown in Figure 2. For prediction of RPCI, the GNRI cut-off value of 94.55 had 89.1% sensitivity and 76.2% specificity; for the prediction of mortality, the GNRI cut-off value of 90.68 had 59% sensitivity and 82.6% specificity in the ROC curve analyses.

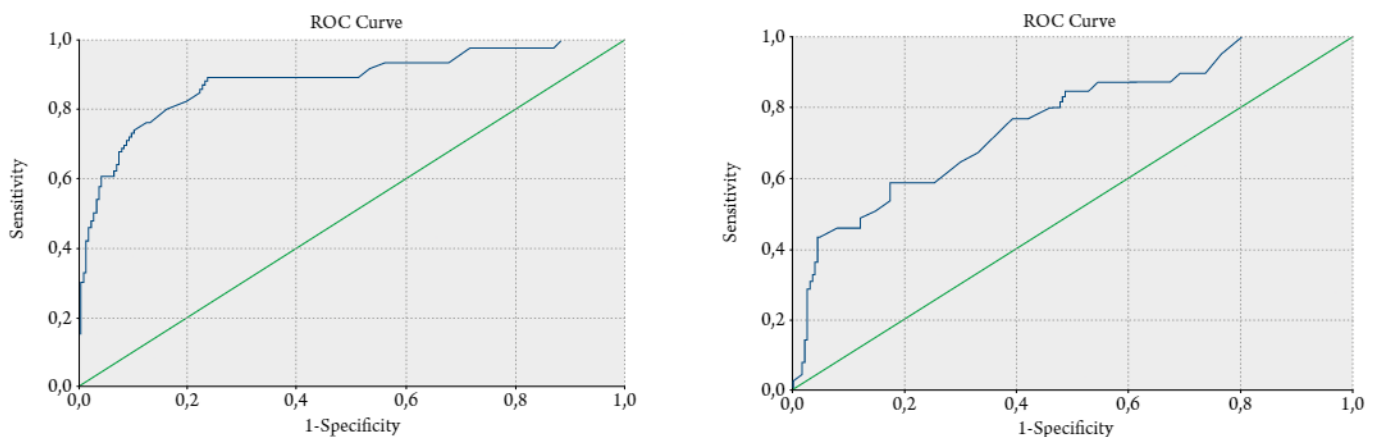
Table 1. Baseline and follow-up patient characteristics for the GNRI levels

Variables	Overall (n=298)	No risk (n=160)	Low risk (n=60)	MTH risk (n=78)	p-value
Age (yrs)	71.5±3	72.1±3	70±4	70.2±3	0.568
Sex (male, %)	217 (72.8%)	117 (73.1%)	42 (70%)	58 (74.4%)	0.843
Weight (kg)	79±7.2	79±7.4	80±7.5	79±7.2	0.593
BMI	26.1±1.5	27.6±1.9	26.1±1.5	25.1±1.2	<0.001*
Diabetes Mellitus (n, %)	126 (42%)	68 (42.1%)	22 (36%)	37 (47.4%)	0.341
Hypertension (n, %)	146 (49.0%)	75 (46.8%)	30 (50%)	40 (51.1%)	0.658
Smoking (n, %)	127 (42.6%)	67 (41.9%)	29 (48.3%)	31 (39.7%)	0.577
CABG (n, %)	29 (9.7%)	10 (6.3%)	7 (11.7%)	12 (15.4%)	0.071
PCI History (n, %)	109 (36.6%)	64 (40.0%)	25 (41.7%)	37 (47.4%)	0.216
CKI (n, %)	20 (6.7%)	10 (6.3%)	3 (5%)	7 (9%)	0.640
Hemodialysis (n, %)	4 (1.3%)	1 (0.6%)	1 (1.7%)	2 (2.6%)	0.409
LVEF (%)	52±1	51±1	53±3	52±2	0.110
Hemoglobin (g/dl)	13.9±1.3	13.9±1.9	14±1.8	13.8±1.8	0.663
Plasma fasting glucose (mg/dl)	131±42	132±47	137.5±39	138.5±41	0.900
Albumin (g/dl)	3.2±0.3	3.4±0.3	3±0.3	2.8±0.3	<0.001*
Creatinine (mg/dl)	0.82±0.1	0.80±0.2	0.82±0.1	0.80±0.2	0.660
eGFR (ml/min)	92±14	92±13	91±14	89±15	0.202
ALT (IU/l)	22±7	22.5±7	20.5±7	23±7	0.890
AST (IU/l)	29.5±11	29.5±10	25.5±11	33±14	0.137
LDL (mg/dl)	134±20	133±21	129±31	137±19	0.637
Triglycerides (mg/dl)	157.5±57	158±61	159±68	155±72	0.524
HDL (mg/dl)	41±7	40±7	41±7	41.3±10	0.977
BNP (pg/ml)	768 (827)	588 (781.3)	942 (1071)	1090 (913.2)	0.173
Troponin (ng/ml)	675±217	620±373	562±285	1171±515	0.152
CRP (mg/l)	5.5±4	5.7±4	5±5	5±5	0.858
Follow-up (mo)	32.9±2.5	33.2±2.5	32.1±3	32.4±2.5	0.800
RPCI (n, %)	46 (15.4%)	5 (3.1%)	4 (6.7%)	37 (47.4%)	<0.001*
Follow-up AF (n, %)	74 (24.8%)	31 (19.4%)	20 (33.3%)	23 (29.5%)	0.056
Hospitalization times	3 (1)	3 (1)	3 (1.5)	3 (1.1)	0.445
Mortality (n, %)	39 (13.1%)	9 (5.6%)	7 (11.7%)	23 (29.5%)	<0.001*
GNRI	98±6	101.8±3	94.7±1.5	85±3.6	<0.001*

Baseline and follow-up characteristics are presented as mean±standard deviation or median (quartile deviation), and categorical variables are presented as percentages. GNRI, geriatric nutritional risk index; RPCI: Repeat PCI; MTH, moderate to high; CABG, coronary artery bypass graft surgery; PCI, percutaneous coronary intervention; AF, atrial fibrillation; HF, heart failure; CKI, chronic kidney injury; LVEF, left ventricle ejection fraction; AST, aspartate aminotransferase; ALT, alanine aminotransferase; eGFR, estimated glomerular filtration rate; LDL-C, low density lipoprotein cholesterol; HDL-C, high density lipoprotein cholesterol; BNP, brain natriuretic peptide; CRP, C-reactive protein.

* – statistically significant, p<0.05.

Figure 2. ROC curve of GNRI according to RPCI and mortality, from left to right



AUC, area under the curve; ROC, receiver operating characteristic. For RPCI, AUC=0.881 (p<0.001), cut-off value = 94.55 with 89.1% sensitivity and 76.2% specificity. For mortality, AUC=0.762 (p<0.001), cut-off value = 90.68 with 59% sensitivity and 82.6% specificity.

Table 2. Baseline and follow-up characteristics for RPCI and non-RPCI

Variables	Non- RPCI (n=252)	RPCI (n=46)	p-value
Age (yrs)	71.5±3	71.5±3.5	0.908
Sex (male, %)	182 (72.2%)	35 (76.1%)	0.853
Weight (kg)	80±7.5	78.5±9.6	0.131
BMI	26.3±1.2	25.2±1.1	<0.001*
Diabetes Mellitus (n, %)	101 (40.1%)	24 (52.2%)	0.341
Hypertension (n, %)	123 (48.8%)	21 (45.7%)	0.658
Smoking (n, %)	110 (43.7%)	17 (37%)	0.577
CABG (n, %)	23 (9.1%)	6 (13%)	0.071
PCI History (n, %)	88 (34.9%)	21 (45.7%)	0.016*
CKI (n, %)	16 (6.3%)	4 (8.7%)	0.640
Hemodialysis (n, %)	2 (0.8%)	2 (4.3%)	0.409
LVEF (%)	52 ±2	51±2	0.144
Hemoglobin (g/dl)	14±1.5	13.7±1.6	0.689
Plasma fasting glucose (mg/dl)	131±42	132±55	0.924
Albumin (g/dl)	3.3±0.3	2.5±0.3	<0.001*
Creatinine (mg/dl)	0.8±0.1	0.8±0.1	0.489
GFR (mL/min)	91±14	93±15	0.907
ALT (IU/l)	22±7	23.5±10	0.696
AST (IU/l)	29±10	30±10	0.558
LDL (mg/dl)	133±19	139.5±18	0.414
Triglycerides (mg/dl)	158.5±57	156.5±56	0.994
HDL (mg/dl)	40±7	41.1±10	0.737
BNP (pg/ml)	747.5 (836)	738 (713)	0.925
Troponin (ng/ml)	820.5±111	846±78	0.127
CRP (mg/l)	5.5±4	5.4±5	0.972
Follow-up (mo)	33±2.5	34±2.5	0.593
Follow-up AF (n, %)	63 (25%)	11 (23.9%)	0.056
Hospitalization times	3 (1)	3 (1)	0.782
Mortality (n, %)	25 (9.9%)	14 (30.4%)	<0.001*
GNRI	99.8±4.5	84.6±5.4	<0.001

RPCI: Repeat PCI; GNRI, geriatric nutritional risk index; MTH, moderate to high; CABG, coronary artery bypass graft surgery; PCI, percutaneous coronary intervention; AF, atrial fibrillation; HF, heart failure; CKI, chronic kidney injury; LVEF, left ventricle ejection fraction; AST, Aspartate aminotransferase; ALT, Alanine aminotransferase; eGFR, estimated glomerular filtration rate; LDL-C, low density lipoproteincholesterol; HDL-C, high density lipoproteincholesterol; BNP, Brain natriuretic peptide; CRP, C-reactive protein.

* – baseline and follow-up characteristics are presented as mean±standard deviation or median (quartile deviation), and categorical variables are presented as percentages.

** – statistically significant, p<0.02.

Table 3. Cox proportional hazard regression analysis for mortality

Variable	Hazard Ratio	95% Confidence Interval of Hazard Ratio	p-value
GNRI Levels			<0.001*
Low risk	2.219	0.826–5.960	0.114
MTH risk	5.372	2.485–11.612	<0.001*

* - statistically significant, p<0.001. GNRI levels were associated with increased mortality as follows: Moderate to high risk (HR=5.372).

Discussion

In this study, we found that GNRI values had predictive value for RPCI in patients with NSTEMI. Stent thrombosis and stent restenosis are two of the scenarios that occur in cases of acute coronary syndrome. They require RPCI. We think that the predictive relationship between GNRI, which is a simple, easily calculable value, and RPCI is important.

Malnutrition is still under-recognized, and it can be a cause of illness, since it is related to many health problems. Generally, malnutrition is caused, not only by the process of aging itself, but also by the combination of various social, physiological, and health changes that occur with aging. These include lack of social contact and depression that result frequently in deprived nutritional status, morbidity, prolonged hospitalization, increased health care cost, and reduced quality of life among the elderly population [14, 15]. Thus, management and preventive steps to overcome the deterioration of the health and well-being among the elderly are crucial, and performing nutritional screening and assessment are important.

Chronic inflammation is the main cause of coronary atherosclerosis, and occurrence of NSTEMI is accompanied by increased inflammation. Inflammatory states that are associated with the disease lead to increased production of catabolic cytokines, increased muscle catabolism, and decreased appetite, resulting in a negative effect on plasma albumin. Therefore, a reduction in albumin and body index can be a consequence of poor nutritional status or of inflammation [16]. The GNRI is said to identify potential patients requiring nutritional support. It appears that the GNRI is practical and provides a reliable nutritional assessment of the elderly in most health care [17].

Recent epidemiological studies used the GNRI to predict outcomes of cardiovascular disease (CVD), and they showed that the GNRI score was independently associated with CV events in HF patients [18]. Evidence supporting a lower GNRI at discharge as a significant predictor of all-cause death in patients hospitalized with HF includes a per point increase in the GNRI that was associated with a lower risk of all-cause death. The results of the one recent study indicate that screening nutritional status using a GNRI at discharge further refines risk assessment in patients hospitalized with HF [19]. Our results agree with the literature by showing

Table 4. Binomial logistic regression according to RPCI

Variable	β estimates with standard errors	OR	95% Confidence Interval of OR	p-value
GNRI Levels				<0.001*
Low Risk (β1)	0.795±0.689	2.214	0.574–8.540	0.248
MTH Risk (β1)	3.331±0.508	27.976	10.340–75.688	<0.001*

* – statistically significant, p<0.001.

that all-cause death occurred more frequently in NSTEMI patients with major nutrition related risk group.

There are several potential explanations for the relationship between low GNRI and CV events in patients with HF. First, malnutrition, which can be caused by metabolic disorder and chronic inflammation, is a prognostic marker in patients with symptomatic HF and on hemodialysis [6]. Second, consistent with previous reports [13], patients with low a GNRI were more likely to have characteristics of frailty. Frailty represents a state of increased vulnerability to stressors resulting from multisystem dysregulation that accompanies aging and is associated with a higher risk of impaired physical functioning and mortality [20]. Third, the change in HF patients' body composition is important because of the reduction in lean mass and muscle wasting, as defined by the criteria of sarcopenia, that is associated with poor exercise capacity. Indeed, increased malnutrition risk, as assessed by GNRI values, is associated with muscle dysfunction in the elderly [21]. Given that multiple comorbidities often coexist and overlap in patients with HF, lower GNRI values may reflect an advanced phase of systemic illness, contributing to the progression of HF. Also in our study, all-cause mortality in the NSTEMI group was higher in the low GNRI group, and we think that this difference was due to conditions similar to HF.

In recent years, the relationship between CV diseases and GNRI has been examined. In one study, Cereda et al. [22] investigated the impact of the GNRI, length of stay in the hospital, and weight loss during hospitalization in elderly patients and found that the GNRI could predict all-cause and CV mortality. In another study, Kinugasa et al. [13] reported that malnutrition assessed by the GNRI on admission was an independent determinant of long-term death in acute HF with preserved EF. One retrospective study confirmed that the GNRI score is an independent risk factor for CV mortality in patients with ST-segment elevation myocardial infarction (STEMI). Thus, the GNRI score may be used to risk stratify patients with STEMI in the emergency room, with respect to short- and long-term outcomes at an early disease stage, and to identify those who would benefit from further assessment of nutritional status and possibly from nutritional intervention [19]. Mortality was higher in the MTH risk group, similar to the results of the current study, but additionally, the current finding of higher RPCI in the MTH risk group is valuable. In all groups, the significant lower GNRI in patients with RPCI is remarkable, which is one of the important results of this study.

In the studies of Keskin et al. [23] and Yoo et al. [24], the incidence of cardiogenic shock, malignant dysrhythmia, and mortality was significantly higher in patients with a risk of malnutrition. It should be noted

that a GNRI score of 98 or lower was significant in terms of increased incidence of CV events and mortality. Also Masatoshi et al. [4] stated that a low GNRI represented an independent predictor of major adverse cardiac events (MACE) in HF patients. In our study, 80 percent of the patients who underwent RPCI in the NSTEMI group were in the MTH risk group.

In the literature, the relationship with GNRI has been investigated in diseases associated with inflammation. The GNRI was developed as a screening tool to assess not only the nutritional but also the inflammatory status of older in patients. The GNRI has been shown to correlate well with indicators of inflammation and length of hospitalization [25]. Apart from that, Matsuo et al. [26] in a current study stated that patients with severe PAD and lower GNRI had severe systemic atherosclerosis leading to higher mortality. GNRI was found to be an independent predictor of MACE and MACE plus limb events (MACLE) in patients with PAD. A simple and practical assessment of GNRI may be useful for predicting long-term outcomes in patients with PAD.

Coexistence of atherosclerosis and inflammation is a known fact. MACE was always high in HF, PAD, and STEMI groups with low GNRI. With regard to NSTEMI patients, our study will contribute to the literature, and the correlation of RPCI with low GNRI values may contribute to clinical approaches. We think that it is important that the simple and easily calculable GNRI predicts RPCI in elderly patients who are fragile. Further research is required to determine if nutritional interventions aimed improving GNRI provide a survival benefit or slows the progression of symptoms in malnourished NSTEMI patients.

In conclusion, our findings suggest that the GNRI is a strong predictor for all-cause mortality and recurrent interventions in NSTEMI patients.

Study Limitations

The small sample size is the main limitation of this study.

Informed consent

The study protocol was approved with registration number of 2020-107 by the ethics committee of Gaziantep University.

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