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The Relationship Between Mortality and Leuko-Glycemic Index in Coronary Care Unit Patients (MORCOR-TURK LGI)

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Abstract

Introduction&Objective: Identifying high-risk patients with a poor prognosis in coronary care unit (CCU) patients can assist physicians in providing optimal care and implementing preventive strategies. Leuko-glycaemic index (LGI), synthesized by multiplying the blood glucose level by the leukocyte count, has gained popularity in risk stratification of myocardial infarction patients. In this context, this study was carried out to investigate the relationship between LGI assessed at admission and in-hospital mortality in CCU patients.

Methods: This is a multi-center, cross-sectional and observational study. (MORCOR-TURK LGI: Mortality Predictors in Coronary Care in Turkey, ClinicalTrials.gov number NCT05296694). The population of this study consisted of 2917 consecutive patients admitted to the CCU. Blood samples were collected into serum separator tubes in the immediate admission to the CCU. LGI was calculated by multiplying both values and dividing them by a thousand. LGI units were expressed in mg/dl. mm^3. The sample was divided into two groups based on the LGI cut-off value of 1.23. Logistic regression analysis was used to find the significant predictors of mortality. Receiver operating characteristics (ROC) curve was to find out the cut-off value of LGI. A p value less than 0.05 was considered to be statistically significant in all analyses.

Results: Univariable logistic regression analysis revealed that age, heart failure (HF), LGI, coronary artery disease, hypertension, diabetes mellitus and atrial fibrillation are clinically and statistically significant predictors. Further analysis of these variables using the multivariable logistic regression analysis indicated that age (Odds Ratio [OR]: 1.040, 95% confidence interval [CI]: 1.017-1.063; p=0.001), HF (OR: 2.426, 95% CI: 1.419-4.149; p:0.001) and LGI (OR: 1.349, 95% CI: 1.176-1.549; p<0.001), were independent predictors for the development of in-hospital mortality in CCU. LGI score optimal cut-off value of >3.72 predicted in-CCU mortality with 95.56% sensitivity and 49.19% specificity ([AUC]: 0.659 [95% CI: 0.641–0.676, p<0.001]).

Conclusion: LGI, a simple and inexpensive index, was associated with in-hospital mortality in CCU patients. Aggressive treatment strategies should be adopted for these patients with higher LGI upon admission. Prospective studies are needed to clarify the prognostic relevance of LGI and CCU patients' mortality in terms of future cardiovascular events.

Keywords: leuko-glycemic index, in-hospital mortality, critical care, coronary care unit.

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Koroner Bakım Ünitesindeki Hastalarda Mortalite ile Löko-Glisemik İndeks Arasındaki İlişki (MORCOR-TURK LGI)

Öz

Giriş ve Amaç: Koroner bakım ünitesi (KBÜ) hastalarında prognozu kötü olan yüksek riskli hastaların belirlenmesi, hekimlere optimal bakımın sağlanmasında ve önleyici stratejilerin uygulanmasında yardımcı olabilir. Kan şekeri düzeyinin lökosit sayısıyla çarpılmasıyla hesaplanan löko-glisemik indeks (LGI), miyokard enfarktüsü hastalarının risk sınıflandırmasında popülerlik kazanmıştır. Bu bağlamda bu çalışma YBÜ hastalarında başvuruda değerlendirilen LGI ile hastane içi mortalite arasındaki ilişkiyi araştırmak amacıyla yapılmıştır.

Yöntemler: Bu çok merkezli, kesitsel ve gözlemsel bir çalışmadır. (MORCOR-TURK LGI: Türkiye'de Koroner Bakımda Mortalite Öngörücüleri, ClinicalTrials.gov numarası NCT05296694). Bu çalışmanın evrenini YBÜ'ye kabul edilen ardışık 2917 hasta oluşturmuştur. KYBÜ'ne hemen kabul sırasında kan örnekleri serum ayırıcı tüplere toplandı. LGI her iki değerin (lökosit ve glukoz) çarpılıp bine bölünmesiyle hesaplandı. LGI birimleri mg/dl.mm^3 cinsinden ifade edildi. Örneklem LGI kesme değeri olan 1,23'e göre iki gruba ayrıldı. Mortalitenin anlamlı belirleyicilerini bulmak için lojistik regresyon analizi kullanıldı. LGI'nin kesme değerini bulmak için ROC eğrisi hesaplandı. Tüm analizlerde p değerinin 0,05'in altında olması istatistiksel olarak anlamlı kabul edildi.

Bulgular: Tek değişkenli lojistik regresyon analizi, yaş, kalp yetmezliği (KY), LGI, koroner arter hastalığı, hipertansiyon, diyabet ve atriyal fibrilasyonun klinik ve istatistiksel olarak KYBÜ'de mortalite için anlamlı belirleyiciler olduğunu ortaya çıkardı. Çok değişkenli lojistik regresyon analizi kullanılarak bu değişkenlerin daha ileri analizi, yaş (Olasılık Oranı [OR]: 1,040, %95 güven aralığı [CI]: 1,017-1,063; p=0,001), KY (OR: 2,426, %95 GA: 1,419-4,149; p:0,001) ve LGI (OR: 1,349, %95 CI: 1,176-1,549; p<0,001), CCU'da hastane içi mortalite gelişiminin bağımsız belirleyicileriydi. LGI skoru optimal kesme değeri, %95,56 duyarlılık ve %49,19 özgüllük ile CCU'da öngörülen mortalite için >3,72'dir ([AUC]: 0,659 [%95 GA: 0,641–0,676, p<0,001]).

Sonuç: Basit ve ucuz bir indeks olan LGI, YBÜ hastalarında hastane içi mortalite ile ilişkiliydi. LGI'si yüksek olan bu hastalar için başvuru sırasında agresif tedavi stratejileri benimsenmelidir. LGI ve CCU hastalarının mortalitesinin gelecekteki kardiyovasküler olaylar açısından prognostik önemini açıklığa kavuşturmak için prospektif çalışmalara ihtiyaç vardır.

Anahtar kelimeler: löko-glisemik indeks, hastane içi mortalite, yoğun bakım, koroner bakım ünitesi.

INTRODUCTION

Cardiovascular disease stands as the leading cause of death worldwide. The most recent estimates in 2019 revealed an incidence of 523 million cardiovascular events, causing more than 18 million deaths (32% of all mortality) worldwide. More than 75% of cardiovascular deaths are reported in middle- and low-income countries, with myocardial infarction (MI) of etiology in about half of the cases[1].

Identifying high-risk patients with a poor prognosis for cardiovascular diseases can assist physicians in providing optimal care and implementing preventive strategies[2]. The use of blood biomarkers and decision tools has been shown to be promising in risk stratification of patients[3]. The temporal profile of inflammatory markers released in the primary systemic response to ischemic heart disease may be helpful in diagnosing and predicting the severity of ischemic injury. In this regard, numerous studies have demonstrated that the increased concentration of specific inflammatory biomarkers is associated with the outcome of patients following acute MI[4]. However, the low specificity, high cost, and lack of these biomarkers in some settings hinder their clinical applicability.

Coronary care units (CCUs) were first established in the late 1960s to improve mortality after acute MI by detecting and aggressively treating arrhythmias while providing a clinical laboratory for further research and treatment of acute coronary syndromes[5]. Established intensive care unit (ICU) risk scores, such as the Acute Physiology and Chronic Health Assessment (APACHE) and Sequential Organ Failure Assessment (SOFA) scores, are currently used for death risk stratification, adjustment for disease severity, and adequate balance between the randomized groups in critically ill populations[6,7]. The complexity and ease of calculating these ICU risk scores varies: SOFA and OASIS scores include 10 variables, and more than 20

variables are required to calculate the APACHE score, including physiological variables that reflect disease severity, conditions of admission, and diagnosis of admission. Each of these ICU risk scores showed similar, very good discrimination (ability to distinguish survivors fromnonsurvivors) for in-hospital mortality in unselected CCU cohorts, although the calibration (performance over the entire predicted mortality range) was poor overall[8]. Although specific risk scorings have been developed for ICUs, specific risk scorings have not been developed for CCUs.

Hyperglycemia can cause thrombosis and fibrinolysis leading to the formation of atherosclerotic plaques. Moreover, leukocytes are very important blood cells in inflammatory diseases[9]. Increased leukocyte levels are significantly associated with atherosclerosis and cardiovascular disease. Therefore, leukocyte levels have been used as an important indicator for assessing cardiovascular disease risk9. In 2010, Quiroga Castro et al. introduced the leuko-glycemic index (LGI) as a prognostic model for acute MI[10]. LGI, synthesized by multiplying the blood glucose level by the leukocyte count, has gained popularity in risk stratification of MI patients[11]. The simplicity of calculation and routine measurement of relevant variables among MI patients at admission made the LGI an accessible and easily interpretable test without significant cost to patients and healthcare systems. Previous studies have shown that LGI is a good clinical marker for acute MI and stroke[12-14].

In this context, this study was carried out to investigate the relationship between LGI assessed at admission and in-hospital mortality in CCU patients.

METHODS

Study Population

This is a multi-center cross-sectional andobservational study (MORCOR-TURK LGI: Mortality Predictors in Coronary Care in Turkey, ClinicalTrials.gov ID NCT05296694). The population of this study consisted of 3157 consecutive patients admitted to the CCU between 1-30 September 2022. Age< 18 years, chronic inflammatory disease, previously diagnosed with CAD, thyroid disorders, hemolytic disease, malignancy, chronic lung diseases, liver diseases, rheumatic disease and nonregulated diabetes mellitus were excluded. An additional eight patients with missing data in the hospital's electronic database were excluded from the study. In the end, 2917 patients were included in the study sample. Baseline demographic and clinical characteristics were obtained for each patient from the hospital's electronic database. The LGI scores were calculated for each patient. The study protocol was approved by hospital's ethics and research committee. The study was carried out in accordance with the ethical principles set forth in the Declaration of Helsinki. Written informed consent was obtained from all patients.

Definitions

STEMI was diagnosed based on the presence of typical chest pain lasting >30 min and/or other angina-equivalent symptoms, e.g., fainting, shortness of breath, dizziness, and sweating, with at least one of the following electrocardiographic (ECG) findings, i.e., at least two contiguous leads with ST-segment elevation of ≥ 2.5 mm in men <40 years, ≥2 mm in men ≥40 years, or ≥1.5 mm in women in leads V2-V3 and/or ≥1 mm in other leads [in the absence of left ventricular hypertrophy or left bundle branch block[15]. In patients with inferior MI, right precordial leads (V3R and V4R) should be recorded for ST-segment elevation to determine concurrent right ventricular infarction. Similarly, ST-segment depression in leads V1-V3 signals myocardial ischemia, particularly when the terminal T-wave is positive (ST-segment elevation equivalent), and

confirmation by simultaneous ST-segment elevation ≥.5 mm in leads V7-V9 could be regarded as a way of identifying posterior acute myocardial infarction (AMI)[15]. Patients with acute chest discomfort but no persistent ST-segment elevation [non-ST-segment elevation ACS (NSTE-ACS)] exhibit ECG changes that may include transient ST-segment elevation, persistent or transient ST-segment depression, T-wave inversion, flat T waves, or pseudo-normalization of T waves; or the ECG may be normal. The pathological correlate at the myocardial level is cardiomyocyte necrosis [non-ST-segment elevation myocardial infarction (NSTEMI)] or, less frequently, myocardial ischaemia without cell damage (unstable angina)[16].

Reduced left ventrcilular ejection fraction (LVEF) is defined as <_40%, i.e. those with a significant reduction in LV systolic function. This is designated as heart failure with reduced ejection fraction (HfrEF). Patients with a LVEF between 41% and 49% have mildly reduced LV systolic function, i.e. heart failure with mildly reduced ejection fraction HFmrEF. Those with symptoms and signs of HF, with evidence of structural and/or functional cardiac abnormalities and/or raised natriuretic peptides (NPs), and with an LVEF >_50%, have HfpEF[17].

A resting blood pressure ≥140-90 mmHg in ≥2 measurements or taking antihypertensive medication was considered hypertensive (HT). Patients with fasting blood glucose ≥126 mg/dl or postprandial blood glucose ≥200 mg/dl or glycated haemoglobin (HbA1c) ≥6.5 or taking anti-diabetic drugs were considered as diabetes mellitus (DM). A low density lipoprotein cholesterol (LDL-C) level abovethe European Society of Cardiology Guideline threshold or patients who received an anti lipidemic were considered to have dyslipidemia[18]. Transthoracic echocardiography was performed for all patients using a Philips HD 11 XE ultrasound machine (Andover, MA, USA). All measurements were performed according to the guidelines of the American Society of Echocardiography[19].

LABORATORY TESTS

Leuko-Glycemic Index

Blood samples were collected into serum separator tubes in the CCU. Blood glucose levels were expressed in mg/dl, and white blood cells count in cells per mm^3. LGI was calculated by multiplying both values and dividing them by a thousand. LGI units were expressed in mg/dl. mm^3

Statistical Analysis

R program version 3.6.3 was used to calculate all statistical analyses (R statistical software, Institute for Statistics and Mathematics, Vienna, Austria). In order to determine if the variables were normally distributed, the Kolmogorov-Smirnov test was utilized. The continuous variables with normally distributed were denoted with a mean (±SD), and non-normally distributed with median (Q1-Q3). Numbers and percentages were utilized for categorical variables. For the comparison of continuous variables between the groups, the independent Student's t-test and Mann-Whitney U tests were computed. Depending on the case, either the $\chi 2$ test or Fisher's exact test was used to compare the categorical variables between the groups. Univariable logistic regression analysis was utilized to evaluate the relationship between variables and mortality in CCU. Clinically significant factors that had a p-value of 0.25 or lower in the univariable logistic regression analysis were used in the multivariable logistic regression analysis. In regression models, Firth's penalization likelihood method was employed to reduce overestimation. The model did not contain variables that had multicollinearity which was discovered by the logistic regression analysis (variance inflation factor > 3 or tolerance < 0.1). Receiver operating

curves (ROC) were used to compare the discrimination abilities of LGI for patients with low LGI from high LGI using the De-Long test. The 95 % confidence interval (CI) was used to examine the results, and a 2-tailed p-value of 0.05 was accepted as the significant level.

RESULTS

Patients' baseline demographic and laboratory characteristics are given in Table 1. The study sample consisted of 2917 CCU patients. The mean age of the sample was 64±13 years. A total of 1932 (66.2%) patients were male. The sample was divided into two groups based on the LGI cut-off value of 1.23. There was no significant difference between the patients with a low LGI<1.23 and those with a high LGI>1.23; age, gender, smoking status, in mean systolic blood pressure, systolic blood pressure and diastolic blood pressure, presence of CAD, HF and chronic kidney disease (CKD). In addition, there was no difference in high density liporotein (HDL-c), potassium and albumin levels between the groups. Number of patients with HT, DM, atrial fibrillation (AF), stroke and HF were significantly higher in patients with a higher LGI than in those with a lower LGI. The number of patients with a Killip class of 2 to 4 at admission was significantly higher in patients with higher LGI than in those with patients with lower LGI. Patients with higher LGI were more likely to have lower left ventricular ejection fraction (LVEF) and oxygen saturation than those Patients with lower LGI . Additionally the heart rate, levels of glucose, total cholesterol, low density liporotein (LDL-c), triglyceride, creatine, AST, ALT, CRP, hemoglobin, troponin sodium and patient taking positive inotropes were patients with higher LGI. Counts of white blood cell (WBC), platelet, lymphocyte and neutrophil were higher in patients with higher LGI. Finally; considering the main admission diagnosis of the patients in our study, there were more patients with STEMI, decompensated heart failure (HF) and cardiac arrest in the higher LGI group (Table 1).

Table I: The baseline demographic and laboratory characteristics of the CCU patients

	Low LGI Score <1.23 n: 1458		**High LGI Score >1.23 n: 1459**		**All patients n: 2917**		**p-value**
Age (years)	64	±14	65	±12	64	±13	0.844
Gender, n (%) (Male)	986	67.6	946	64.8	1932	66.2	0.111
Patients with DM, n (%)	356	24.4	734	50.3	1090	37.4	**<0.001**
Patients with HT, n (%)	836	57.3	898	61.5	1734	59.4	**0.021**
Active smokers, n (%)	469	32.2	526	36.1	995	34.1	0.094
Patient with CAD, n (%)	667	45.7	659	45.2	1326	45.5	0.753
Patient with AF, n (%)	34	2.3	449	30.7	483	16.5	**0.002**
Patient with HF, n (%)	76	5.2	902	61.8	978	33.5	**<0.001**
Patient with stroke, n (%) (isckemic and hemorrhagic)	48	3.2	84	5.8	132	4.5	**0.001**
Patient with CKD, n (%)	185	12.7	217	14.8	402	13.7	0.091
Main admission diagnosis, n (%)							
STEMI, n (%)	221	15.1	479	32.8	700	23.9	
NSTEMI, n (%)	597	40.9	532	36.4	1129	38.7	
USAP, n (%)	226	15.5	83	5.6	309	10.5	
Decompensated HF, n (%)	177	12.1	212	14.5	389	13.3	
Arrhythmia, n (%)	152	10.4	96	6.5	248	8.5	**<0.001**
Cardiac arrest, n (%)	5	0.34	13	0.89	18	0.61	

Killip class, n (%)							
1	916	74	44	3	1679	68.6	
2	207	16.8	763	62.8	463	18.9	
3	94	7.6	256	21	255	10.4	
4	13	0.1	161	13.2	47	0.2	**<0.001**
SBP (mmHg)	130	±23	130	±25	130	±24	0.663
DBP (mmHg)	78	±14	78	±14	78	±14	0.925
Mean BP (mmHg)	95	±15	95	±17	95	±16	0.628
Patient taking positive inotropes, n (%)	101	7	142	9.7	243	8.3	**0.006**
Heart rate (bpm)	83	±23	86	±22	85	±23	**<0.001**
Oxygen saturation (%)	95	±3.9	94	±5	94	±4.5	**<0.001**
Ejection fraction (%)	50.5	±11.4	46.7	±11.8	48.7	±11.7	**<0.001**
Glucose level (mg/dL)	105	(94-121)	166	(132-232)	126	(103-173)	**<0.001**
Total cholesterol (mg/dL)	171	±49	181	±55	176	±52	**<0.001**
HDL (mg/dL)	40.9	±11.3	41	±11.4	41	±11.4	0.894
LDL (mg/dL)	105.8	±39.2	113.2	±48.8	109.5	±44.4	**<0.001**
Triglyceride (mg/dL)	114	(81-168)	127	(88-181)	120	(83-175)	**<0.001**
Creatine level (mg/dL)	0.95	(0.8-1.17)	1	(0.8-1.29)	0.97	(0.8-1.2)	**<0.001**
Sodium (mEq/L)	138.1	±3.97	136.9	±4	137.6	±4	**<0.001**
Potassium (mEq/L)	4.35	±0.56	4.40	±0.67	4.37	±0.61	0.101
AST (U/L)	25	(19-37)	30	(20-58)	26	(19-45)	**<0.001**
ALT (U/L)	19	(13-28)	22	(15-37)	20	(14-32)	**<0.001**
CRP (mg/dL)	4.1	(1.65-12)	7.35	(2.5-21.8)	5.46	(2-17)	**<0.001**
Albumin level (g/L)	39.6	5.4	39.5	5.2	39.6	5.3	0.985
Hemoglobin level (mg/dL)	13.2	±2.2	13.4	±2.2	13.3	2.2	**0.049**
WBC count (10^3/ml)	7.94	±2.06	12.11	±3.72	10	±3.6	**0.001**
Platelet count (10^3/ml)	229	±72	256	±83	243	±79	**<0.001**
Neutrophil count (10^3/ml)	5.44	±2.21	8.87	±3.64	7.16	±3.46	**<0.001**
Lymphocyte count (10^3/ml)	1.8	(1.29-2.47)	1.95	(1.3-2.9)	1.87	(1.3-2.61)	**<0.001**
Troponin (ng/mL) (at admission)	27	(3.8-240.3)	60	(7.59-761)	41.2	(5-442)	**<0.001**
LGI (mg/dl. mm³)	0.86	(0.7-1.04)	1.87	(1.48-2.61)	1.23	(0.86-1.87)	**<0.001**

Abbreviations: CCU: coronary care unit, DM: diabetes mellitus, HT: hypertension, CAD: coronary artery disease, AF: atrial fibrillation, HF: heart failure, CKD: chronic kidney disese, STEMI: ST-Segment Elevation Myocardial Infarction, NSTEMI: NonST-Segment Elevation Myocardial Infarction, USAP: unstable angina pectoris, LDL: low density lipoprotein, HDL: high density liporotein, SBP: systolic blood pressure, DBP: diastolic blood pressure, bpm: beats per minute, WBC: white blood cell, LGI: Leuko-gylicaemic index.

Univariable logistic regression analysis revealed clinically and statistically significant predictors age, HF, LGI, coronary artery disease, HT, DM and AF (Table 2). Further analysis of these variables using the multivariable logistic regression analysis indicated that age (Odds Ratio [OR]: 1.040, 95% confidence interval [CI]: 1.017-1.063; p=0.001), HF (OR: 2.426, 95% CI: 1.419-4.149; p=0.001) and LGI (OR: 1.349, 95% CI: 1.176-1.549; p<0.001), were independent predictors for the development of in-hospital mortality (Table 2).

Table II: Results of the univariate and multivariate analyses of the variables

	Univariate Analysis			Multivariate Analysis		
	Univariate OR, 95% CI		p-value	Multivariate OR, 95% CI		p-value
Age	1.050	(1.035-1.066)	**<0.001**	1.040	(1.017-1.063)	**0.001**
HF	2.926	(2.070-4.134)	**<0.001**	2.426	(1.419-4.149)	**0.001**
LGI	1.349	(1.222-1.489)	**<0.001**	1.349	(1.176-1.549)	**<0.001**
CAD	0.750	(0.433-1.298)	0.304	-	-	**-**
Hypertension	0.784	(0.448-1.372)	0.394	-	-	**-**
DM	0.909	(0.512-1.613)	0.745	-	-	**-**
AF	1.700	(0.778-3.716)	0.183			

Abbreviations: HF: heart failure, LGI: Leuko-gylicaemic index, OR: odds ratio, CI: confidence interval, p: probability statistic, CAD: coronary artery disease, DM: diabetes mellitus, AF: atrial fibrillation.

The area under the ROC curve (AUC) values for the variables analyzed by ROC curve analysis in terms of prognostic power in predicting in-CCU mortality was as follow: LGI score optimal cut-off value of >3.72 predicted in-CCU mortality with 95.56% sensitivity and 49.19% specificity ([AUC]: 0.659 [95% CI: 0.641–0.676, p<0.001]) (Figure 1).

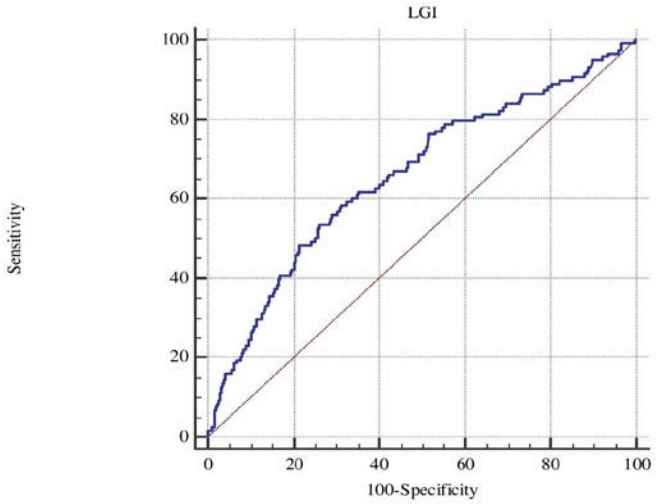

Figure 1: ROC curve analysis of LGI score to predict mortality in CCU

DISCUSSION

This is the first study to demonstrate the predictive value of the LGI in CCU patients'mortality. This study's findings indicate that LGI is an independent predictor of mortality in CCU patients and increased LGI was associated with higher in-hospital mortality in CCU patients.

LGI includes two accessible indicators: the leukocyte count and the blood glucose level at the time of admission. Leukocytes are the main mediators of inflammation. An increase in the count of leukocytes reflects the inflammatory state of the body. Peripheral leukocyte count is closely associated with heart failure, cardiogenic shock and death in patients with AMI. Studies have shown that leukocyte count is an indicator of mortality in patients with AMI, and a higher leukocyte count is associated with increased in-hospital or short-term mortality in AMI patients9. Severe stress hyperglycemia (≥200 mg/dL) in patients without DM in CCU may increase the risk of short-term death, which is greater than the prognostic effect in patients with diabetes[20]. The release of inflammatory mediators during a stress state also affects glucose metabolism and promotes a hyperglycemic state. AMI patients often experience hyperglycemia, regardless of their diabetes history[19]. Acute hyperglycemia may increase the inflammatory response. A previous study showed a significant association between hyperglycemia and elevated leukocyte counts at presentation in patients with AMI[21]. LGI is an index that combines white blood cell count and blood sugar levels. It is calculated by multiplying both values and dividing by a thousand. It was first described in 2010 by Quiroga Castro et al. to determine the prognostic value in patients with AMI[22]. The above studies show that it is reasonable and feasible to combine leukocyte and blood glucose levels as a new parameter in the mortality prediction with CCU patients. In this study,

LGI>3.72 mg/dl.mm3 was associated with in-hospital mortality in CCU. Hirschson Prado et al. also showed that high LGI is an independent predictor of poor prognosisin AMI(hospital death or Killip grade 3-4)[22]. Although it is a new prognostic index, it has been evaluated in a small number of patients. Later, Leon et al., Rodriguez Jimenez et al. and Kahraman F. et al. further proved that high LGI during AMI may be associated with a higher in-hospital mortality[23,24].

The observed and reported mortality rate is significantly lower than what was in the range of 25-35% reported by the Myocardial Infarction Research Units in the 1960s5. Of course, advances in revascularization therapy, arrhythmia detection and treatment, and pharmacotherapy have contributed to improved survival. In addition to the reduction in overall mortality, the death rate from AMI has also fallen from about 20-25% in the 1980s to 10-15% in the 1990s and to about 6% today[5].

In our study, age and HF, which are other independent predictors of in-hospital mortality, were reported to be associated with mortality in the literature[25,26]. Differently, for the first time in the literature, the relationship between LGI and CCU patients with in-hospital mortality was revealed. In our study, HT was more common in the group with high LGI. A relationship between HT and LGI has not been reported in the literature. We think that studies are needed on this subject. In our study, LGI was found to be higher in diabetic patients, similar to the literature. However, LGI has found no prognostic value for the short- and long-term prognosis of acute MI patients with diabetes. In the literature, higher LGI and more AF associations were found in patients who underwent postoperative coronary artery bypass grafting[12]. Although there is no direct study between LGI and heart failure (HF) in the literature, no difference was found between lower and higher LGI groups in terms of HF in the study of Seoane LA et al[12]. In our study, although there was no difference for HF, the ejection fraction was found to be lower in the higher LGI group. As in the study of Caldas FA et al., a relationship was found between stroke and LGI in our study. Caldas FA et al. showed that LGI is a risk marker for predicting mortality in patients with ischemic stroke[14]. The relationship between Killip class and mortality is well known[22]. In our study, higher killip classes were found in the higher LGI group. Hirschson Prado et al also showed that high LGI was an independent predictor of poor evolution in acute myocardial infarction (in hospital death or Killip class 3-4)[22]. Similar to the study by Sadeghi R et al., in our study, patients diagnosed with STEMI were more common in the higher LGI group[27,28].

Regarding clinical relevance, LGI, a simple index that can be used in any intensive care unit, is easy to calculate and with low cost, and can be used for risk stratification and mortality prediction of CCU patients. Patients with high LGI values may benefit from greater monitoring and early therapeutic strategies.

Limitations of the Study

This study had some limitations. First, this was a cross-sectional study and there were more confounding factors than prospective studies. Second, the predictive value of LGI was not compared with other prognostic scores. Third, there is a low proportion of women and rather young age of the population included in this study. Moreover, the heterogeneity of our study population is also a limitation of our study.

CONCLUSION

LGI, a simple and inexpensive index, was associated with in-hospital mortality in CCU patients. Aggressive treatment strategies should be adopted for these patients with higher LGI upon admission. Prospective studies are needed to clarify the prognostic relevance of

LGI and CCU patients' mortality in terms of future cardiovascular events.

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