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Immature granulocyte in prediction of the short-term and long-term mortality of patients with acute myocardial infarction

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ABSTRACT

Objectives: Despite great advances in the treatment of acute myocardial infarction (AMI), it is still the most common cause of death in the world. Therefore, predicting mortality in advance is clinically very important. In this study, we aimed to investigate the role of immature granulocyte (IG) and other hematological markers in predicting short- and long-term mortality in patients with AMI.

Methods: Laboratory information system (LIS) data of a tertiary hospital were used in this study. Of the 298 patients who were admitted to the coronary intensive care unit with the diagnosis of myocardial infarction, 258 recovered after treatment and were discharged. 40 of them died. It was determined that 36 of these 258 patients, who were followed up retrospectively, died within 15 months after discharge.

Results: The mean age of 298 people who participated in this retrospective study was 73.26 ± 8.6 years, and 53.3% were male. Moderate and high predictive property in receiver operating characteristic (ROC) analysis for short-term mortality, white blood cell (WBC) area under curve (AUC) = 0.802), neutrophil count (AUC = 0.817), IG count (AUC = 0.841), neutrophil/lymphocyte ratio (NLR) (AUC = 0.701), and C-reactive protein (CRP) (AUC = 0.758) tests detected. For long-term mortality, a moderate predictive feature was observed in the age (AUC = 0.712) parameter.

Conclusions: IG is a marker that does not require extra cost, provides rapid results and has high predictive value in predicting death in the short term in patients with acute myocardial infarction. It is ineffective in predicting long-term mortality.

Keywords: Immature granulocyte count, acute myocardial infarction, mortality, inflammation, hematological markers

Acute myocardial infarction (AMI) is still the most common cause of death in the world, despite all the advances over the past three decades in medical treatments [1]. AMI is triggered by the rupture of atherosclerotic plaques in the coronary arteries. As a result, a thrombotic process begins. Unstable angina or non-ST-segment elevation myocardial infarction (NSTEMI) occurs if the coronary artery lumen is partially occluded, and ST-elevation myocardial infarction (STEMI) occurs if the arterial lumen is

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completely occluded [2-5].

Many pathophysiological factors, including inflammation, trigger this process. Inflammation is effective in initiating atherosclerosis and facilitating its progression [6]. Inflammatory markers such as white blood cell (WBC), C-reactive protein (CRP), neutrophil/lymphocyte ratio (NLR), and WBC to mean platelet volume (MPV) ratio (WMR) have been investigated in many studies as potential prognostic markers in the prediction of short-term and long-term mortality [7-9].

Immature granulocyte (IG), a parameter that is poorly recognized by most clinicians, indicates the immature granulocyte fraction in peripheral blood. The IG count, a indicator of local and systemic inflammation, can be measured using the complete blood count (CBC). In recent years, it has been shown to be useful in predicting the severity and mortality of many disease such as acute pancreatitis, sepsis and cancer [10-12]. It is seen that there are only a few studies in the literature investigating the relationship between the number of IGs and AMI mortality. Therefore, our study aimed to evaluate the importance of IG number in predicting short- (hospital mortality) and long-term (> 12 mounth) [13] mortality in AMI.

METHODS

This retrospective study was conducted in a tertiary education and research hospital. Hospital information processing management system and laboratory information system (LIS) were used to obtain the data, and they were scanned between January 2020 and August 2021. A total of 298 patients who were admitted to the hospital and admitted to the coronary intensive care unit with the diagnosis of AMI (both NSTMI and STMI) were included in the study. Of these, 258 constituted the group that recovered after treatment, while 40 of them formed the group that died despite treatment. It was determined that 36 of these 258 patients, who were followed up retrospectively, died within 15 months after discharge. Pregnant women, patients under the age of 18, trauma patients, those who continued their treatment in another hospital, and patients without hemogram data were excluded from the study. Hemogram tests of both deceased and surviving groups were measured in XN 1000 (Sysmex, Kobe, Japan) device, CRP test was measured in DxC 700AU (Beckman Coulter, Brea, CA, USA) device and hs troponin I test was measured in Unicel Dxi 600 (Beckman Coulter, Brea, CA, USA) devices. Thus, it was tried to estimate the short and long term mortality of the patients from the first blood results obtained when they applied to the hospital.

In order to carry out this retrospective study, necessary permissions were obtained from the Kastamonu University Clinical Research Ethics Committee with the decision dated 20.04.2002 and numbered 2022-KAEK-41.

Statistical Analysis

"Statistical Package for Social Sciences 18.0 for Windows" (SPSS Inc., Chicago, USA) program was used for statistical analysis of the data. Descriptive statistics of the obtained data were given as number and % for categorical variables, and median (25 Percentiles, 75 Percentiles) for numerical variables. The Mann Whitney U test was used to compare the data between the surviving and deceased groups, since the results did not fit the normal distribution. Chi-square test was performed to find out whether there was a significant difference between the two groups in terms of nominally distributed conditions such as gender, hypertension (HT), diabetes mellitus (DM), chronic kidney disease (CKD), smoking, chronic obstructive pulmonary disease (COPD), cardiovascular disease (CVD), and coronary artery disease (CAD). Receiver Operating Characteristic (ROC) analysis was performed and Youden's index was used to determine area under the ROC curve (AUC), cut-off, sensitivity and specificity values. A p value of < 0.05 was considered statistically significant. Univariate and multivariate cox regression analysis were performed for short-term survival analysis. Univariate and multivariate logistic regression analysis were performed for long-term survival analysis.

RESULTS

Data of 298 AMI patients, 142 (47.7%) females and 156 (53.3%) males, were used in the study. The mean age of the patients was 73.26 ± 8.6 years. As additional diseases, 92 (30.8%) patients had HT, 54 (18.1%) had DM, 15 (5%) had CKD, 9 (3.5%) had COPD, 14

Table 1. Comparison of demographic, clinical and hemogram parameters of patients with AMI who died and survived in short-term mortality

Parameters	Deceased (n = 40)	Survival (n = 258)	*p value*
Age (years)	75 (66-80)	67 (63-75)	**< 0.001**
Male gender, n (%)	19 (47.5)	168 (52.7)	0.461
HT, n (%)	9 (22.5)	83 (32.1)	0.192
DM, n (%)	6 (15)	48 (18.6)	0.547
CKD, n (%)	6 (15)	9 (3.4)	**0.002**
Smoker, n (%)	8 (20)	48 (17.4)	0.735
COPD, n (%)	2 (5)	7 (2.7)	0.478
CVD, n (%)	8 (20)	6 (2.3)	**< 0.001**
CAD, n (%)	12 (30)	52 (20.1)	0.179
WBC ($\times10^3$/µL)	15.2 (11.7-18.3)	9.8 (7.9-11.8)	**< 0.001**
RBC (10^6/µL)	4.59 (3.69-4.82)	4.81 (4.42-5.23)	**< 0.001**
Hb (g/dL)	12.2 (10.7-13.7)	13.5 (12.5-15.0)	**< 0.001**
Hct (%)	39.4 (32.2-43.3)	41.0 (37.7-44.9)	**0.003**
MCHC (g/dL)	32.2 (31.4-33.1)	33.1 (32.2-33.9)	**0.001**
RDW-SD (fL)	43.3 (41.2-47.5)	41.2 (39.0-44.1)	**< 0.001**
RDW-CV (%)	13.8 (12.8-15.0)	13.1 (12.5-13.8)	**< 0.001**
PLT ($\times10^3$/µL)	269 (235-339)	245 (201-280)	**0.011**
MPV (fL)	10.4 (10.0-11.1)	10.0 (9.5-10.6)	**< 0.001**
P-LCR (%)	28.3 (25.0-33.7)	24.8 (20.4-29.9)	**< 0.001**
PCT (%)	0.30 (0.24-0.37)	0.22 (0.19-0.27)	**< 0.001**
Neutrophil count ($\times10^3$/µL)	11.6 (8.9-15.5)	6.9 (5.3-9.1)	**< 0.001**
Lymphocyte count ($\times10^3$/µL)	1.61 (1.14-3.31)	1.49 (0.93-2.12)	**0.048**
IG count ($\times10^3$/µL)	0.09 (0.06-0.21)	0.04 (0.02-0.06)	**< 0.001**
IG (%)	0.65 (0.50-1.27)	0.40 (0.30-0.50)	**< 0.001**
NLR	7.8 (4.0-3.9)	3.8 (2.4-7.1)	**0.001**
WMR	1.3 (1.0-1.7)	0.9 (0.8-1.2)	**< 0.001**
Length of stay (day)	2 (1-3.7)	4 (3-4)	**< 0.001**
Hs troponin I (ng/L)	4317 (319-14265)	504 (89-2352.5)	**< 0.001**
CRP (mg/L)	18.9 (7.1-78.5)	5.5 (2.6-11.4)	**< 0.001**

Data are shown as medians (25^{th}-75^{th} percentile) or n (%). AMI = acute myocardial infarctus, HT = hypertension, DM = diabetes mellitus, CKD = chronic kidney disease, COPD = chronic obstructive disease, CVD = cardiovascular disease, CAD = coronary artery disease, WBC = White blood cell, RBC = red blood cell, Hb = hemoglobin, Hct =hematocrit, MCHC = mean corpuscular hemoglobin concentration, RDW-SD = red blood cell distribution width-standard deviation, RDW-CV = red blood cell distribution width- coefficient of variation, P-LCR = platelet large cell ratio, PCT = procalcitonin, IG = immature granulocyte, NLR= neutrophil/lymphocyte ratio, WMR = WBC to mean platelet volume (MPV) ratio, Hs = high-sensitive, CRP = C-reactive protein

(4.6%) had CVD and 64 (21.4%) CAD, and 56 (18.7%) were smokers. When we evaluate the medians (25th-75th percentile) of hematological parameters and then it is recommended WBC (×103/µL) 8.4 (6.6-10.2), red blood cell distribution width-standard deviation RDW-SD (fL) 43.4 (40.4-46.6), RDW-coefficient of variation (RDW-CV) (%) 13.5 (13.0-14.6), neutrophil count (×103/µL) 5.45 (4.19-7.81), IG count (×103/µL) 0.03 (0.02-0.05), IG (%) 0.4 (0.3-0.5) and NLR were found 3.23 (2.07-5.58).

When the demographic, clinical and hemogram data of the patients who died and survived in the short term (Table 1), it will be seen that 40 people constitute the deceased group and 258 the survivor group. When the demographic, clinical and hemogram data of the patients who died and survived in the long term (Table

Table 2. Comparison of demographic, clinical and hemogram parameters of patients with AMI who died and survived in long-term mortality

Parameters	Deceased (n = 36)	Survival (n = 222)	*p value*
Age (years)	73.5 (66.5-78)	66 (61-72)	**< 0.001**
Male gender, n (%)	21 (58.3)	147 (66.2)	0.347
HT, n (%)	12 (46.1)	69 (31)	0.970
DM, n (%)	7 (19.4)	40 (18)	0.946
CKD, n (%)	2 (0.5)	7 (3.1)	0.652
Smoker, n (%)	3 (8.3)	45 (20.2)	**0.048**
COPD, n (%)	2 (0.5)	5 (2.2)	0.340
CVD, n (%)	4 (11.1)	2 (1.3)	**0.001**
CAD, n (%)	14 (38)	69 (31)	0.970
WBC ($\times10^3$/µL)	9.9 (8.02-12.0)	10.2 (8.2-12.7)	0.735
RBC (10^6/µL)	4.52 (4.12-5.00)	4.87 (4.47-5.26)	0.008
Hb (g/dL)	12.7 (11.2-14.0)	13.8 (12.6-15.0)	**0.005**
Hct (%)	38.5 (34.3-42.7)	41.7 (38.2-45.0)	0.007
MCV (fL)	87.3 (83.5-90.9)	85.3 (82.1-88.8)	**0.029**
MCHC (g/dL)	32.4 (31.8-33.0)	33.3 (32.2-34.0)	**0.003**
RDW-SD (fL)	43.6 (40.2-47.7)	41.0 (38.9-43.3)	**0.002**
RDW-CV (%)	13.6 (12.8-15.0)	13.0 (12.4-13.7)	**0.001**
IG count ($\times10^3$/µL)	0.04 (0.02-0.06)	0.04 (0.02-0.06)	0.547
IG (%)	0.40 (0.30-0.575)	0.40 (0.20-0.60)	0.145
NLR	3.76 (3.14-7.04)	3.92 (2.24-7.11)	0.348
WMR	1.00 (0.77-1.21)	0.98 (0.82-1.29)	0.642
Length of stay (day)	4 (3-5.75)	4 (3-4)	0.173
Hs troponin I (ng/L)	1381 (174-4565)	469 (76-2188)	0.052
CRP (mg/L)	8.4 (2.8-20.3)	4.6 (2.3-10.5)	**0.005**

Data are shown as medians (25th-75th percentile) or n (%). AMI = acute myocardial infarctus, HT = hypertension, DM = diabetes mellitus, CKD = chronic kidney disease, COPD = chronic obstructive disease, CVD = cardiovascular disease, CAD = coronary artery disease, WBC = White blood cell, RBC = red blood cell, Hb = hemoglobin, Hct =hematocrit, MCV = mean corpuscular valume, MCHC = mean corpuscular hemoglobin concentration, RDW-SD = red blood cell distribution width-standard deviation, RDW-CV = red blood cell distribution width- coefficient of variation, IG = immature granulocyte, NLR= neutrophil/lymphocyte ratio, WMR = WBC to mean platelet volume (MPV) ratio, Hs = high-sensitive, CRP = C-reactive protein

Table 3. ROC analysis values of some hematological parameters in AMI patients in short-term mortality

Parameters	Cut-off	AUC	95% CI	*p value*	Sensitivity (%)	Specifity (%)
WBC (×10^3/µL)	11.38	.802	0.73-0.88	**< 0.001**	85	66
Neutrophil count (×10^3/µL)	8.68	.817	0.75-0.89	**< 0.001**	85	67
IG count (×10^3/µL)	0.045	.841	0.77-0.91	**< 0.001**	92	62
IG (%)	0.45	.806	0.74-0.88	**< 0.001**	82	70
NLR	6.75	.701	0.61-0.807	**< 0.001**	64	74
WMR	1.01	.754	0.68-0.83	**< 0.001**	90	51
Hs troponin I (ng/L)	2381	.688	0.595-0.79	**< 0.001**	64	75
CRP (mg/L)	11.4	.758	0.68-0.84	**< 0.001**	64	75

AMI = acute myocardial infarctus, ROC = receiver operating characteristic, AUC = area under curve, IG = immature granulocyte, NLR= neutrophil/lymphocyte ratio, WMR = WBC to mean platelet volume (MPV) ratio, Hs = high-sensitive, CRP = C-reactive protein

2), it will be seen that 36 people constitute the deceased group and 222 the survivor group.

In the ROC analysis, it was determined that they showed moderate-high predictive properties with IG count (cut off: 0.045, AUC = 0.841) and IG (%) (cut off: 0.45, AUC = 0.806) (Table 3, Fig. 1). Age was found to be the most predictive marker for long-term mortality (Table 4, Fig. 2). In univariate and multivariate cox regression analyzes RDW-CV, platelet large cell ratio (P-LCR), WBC, hemoglobin concentration (Hb) and IG were found to be independent markers for short-term mortality (Table 5). In univariate and mul-

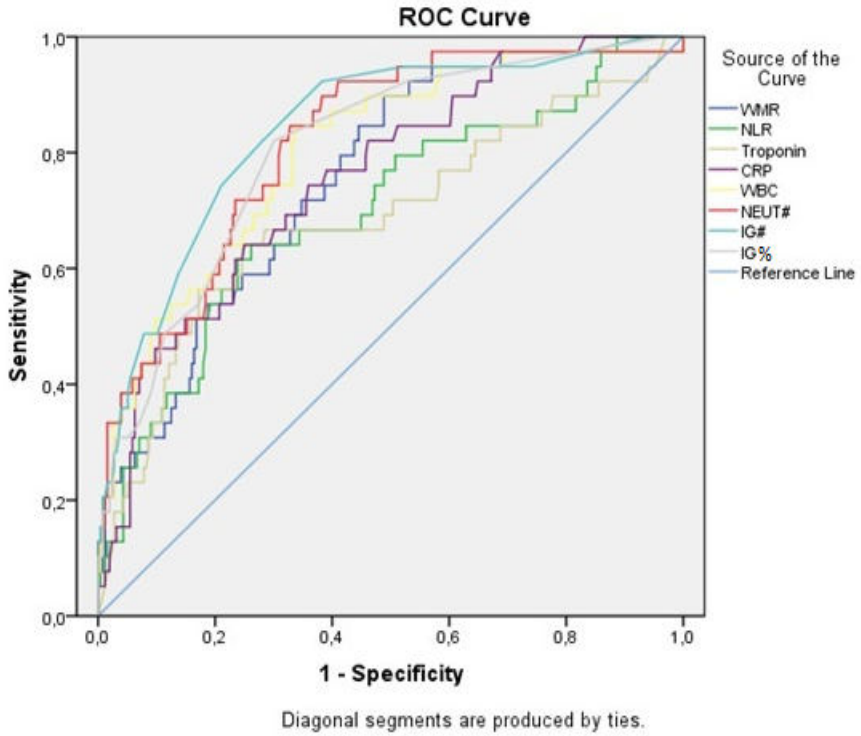

Fig. 1. ROC curve analysis of some hematological data in AMI patients in short-term mortality. AMI = acute myocardial infarctus, ROC = receiver operating characteristic.

Table 4. ROC analysis values of age parameter in AMI Patients in long-term mortality

Parameters	Cut-off	AUC	95% CI	*p value*	Sensitivity (%)	Specifity (%)
Age (years)	68.5	.712	0.63-0.80	**< 0.001**	72	64

AMI = acute myocardial infarctus, ROC = receiver operating characteristic, AUC = area under curve

tivariate logistic regression analyzes, age was found to be independent predictors of long-term mortality (Table 6).

DISCUSSION

The most striking result in our study is the demonstration that IG is a fast, non-expensive and predictive marker for predicting short-term mortality in patients with AMI. In addition, it showed a higher predictive feature than many other parameters that predict mortality in the literature. IG, which has been shown to be an important biomarker in predicting mortality and the severity of the disease in many studies in other diseases, is also promising in patients with AMI. However, it is ineffective in predicting long-term mortality in AMI patients.

he effect of inflammation in the initiation and even progression of coronary atherosclerosis is significant. [14]. In this relationship, which has been known for many years, [2] intensely inflamed atherosclerotic plaques increase the susceptibility to acute coronary syndrome [14]. Inflammation plays an active role in many stages of atherosclerosis, including endothelial dysfunction, leukocyte recruitment and even platelet activation. Neutrophils produce many proteolytic enzymes that cause tissue destruction, such as acid phosphatase, myeloperoxidase, and elastase [16-18]. Moreover, inflammation is highly associated with possible complications and prognosis of AMI [19]. Increasing the intensity of inflammation increases the likelihood of atherosclerotic plaque, which in turn causes MI [20].

Studies have shown that haematological parameters (e.g. WBC, NLR, neuthrophil count, etc.) in AMI have been of great interest as they can provide independent information on prognosis and risk stratifica-

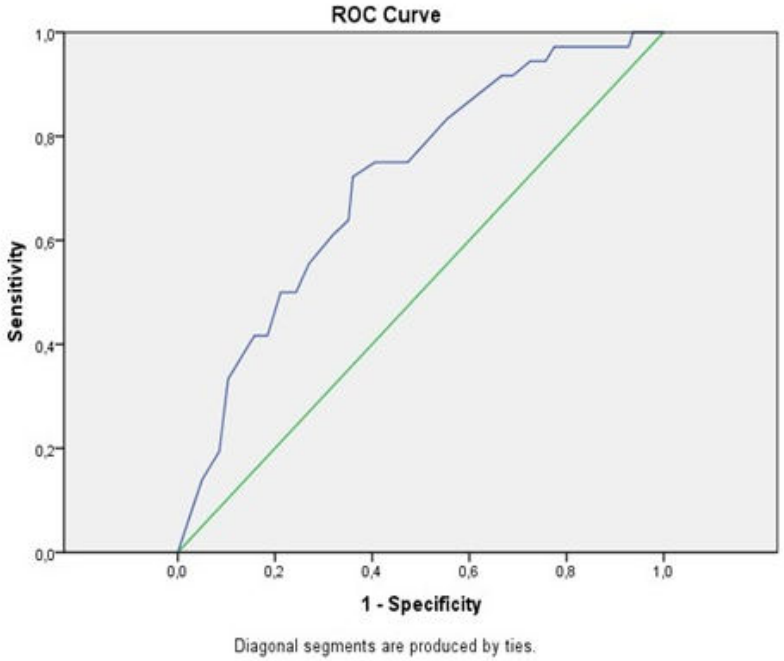

Fig. 2. ROC curve analysis of age parameter in AMI patients in long-term mortality. AMI = acute myocardial infarctus, ROC = receiver operating characteristic.

Table 5. Cox regression in short-term mortality in AMI patients

	Univariate HR (95% CI)	*p value*	Multivariate HR (95% CI)	*p value*
Sex	0.502 (0.266-0.947)	**0.033**	1.038 (0.498-2.166)	0.920
Age	1.059 (1.019-1.101)	**0.004**	1.010 (0.970-1.053)	0.625
RDW-CV (%)	1.270 (1.108-1.457)	**0.001**	1.297 (1.075-1.566)	0.007
P-LCR (%)	1.072 (1.029-1.117)	**0.001**	1.083 (1.032-1.136)	**0.001**
WBC (×10^3/µL)	1.139 (1.083-1.197)	**< 0.001**	1.111 (1.052-1.173)	**< 0.001**
Hb (g/dL)	0.748(0.645-0.868)	**< 0.001**	0.783 (0.658-0.931)	0.006
IG count (×10^3/µL)	1.643(1.385-1.949)	**< 0.001**	1.319 (1.036-1.679)	**0.025**

AMI = acute myocardial infarctus, RDW-SD = red blood cell distribution width-standard deviation, RDW-CV = red blood cell distribution width- coefficient of variation, WBC = White blood cell, Hb = hemoglobin, IG = immature granulocyte

tion [21]. In addition, troponin, CRP, and NLR were used both in clinical scoring and as prognostic indicators [22].

NLR is one of the parameters that have been published in many articles in recent years to predict short- and long-term mortality in patients with STEMI and NSTEMI [23-25]. There are clinical and meta-analysis studies showing that NLR can be independent factor in determining AMI [9, 26, 27]. In a study by Basem Azab *et al*. [23], in which they looked at the long-term mortality prediction rate in NSTEMI patients, it was shown that NLR showed a better predictive value of 4.7 than all other hemogram parameters. In our study, NLR showed short-term mortality, the cut-off value was 6.75, AUC value was 0.701, sensitivity was 64% and specificity was 74%. This value was found to be the cut-off point for the estimation of mortality in patients who had a heart attack. In addition, the neuthrophil count cut-off value was 8.68, the AUC value was 0.817, the sensitivity was 85%, and the specificity was 67%. With these values, neuthrophil count shows a high predictive feature in mortality in AMI patients. In our study, NLR was found to be ineffective in demonstrating long-term mortality in contrast to some studies in the literature [23, 28]. This may be because they are examining a much longer period of time than 15 months, or the NLR they calculated is not the NLR at the time of first admission to the hospital (Tables 3 and 4).

WBC has been an important prognostic marker in demonstrating short-term and mid-term mortality in patients with AMI [29]. Clinical evidence that WBC can be independent factor in determining mortality and meta-analysis studies are accessible [9, 26, 27]. Çiçek *et al*. [9] showed that WBC is an important marker in demonstrating mortality and found a cut-off value of

Table 6. Logistic regression analysis in long-term mortality in AMI patients

	Univariate HR (95% CI)	*p value*	Multivariate HR (95% CI)	*p value*
Sex	0.714 (0.348-1.465)	0.359	1.662 (0.686-4.027)	0.261
Age	1.095 (1.043-1.149)	**< 0.001**	1.074 (1.022-1.129)	**0.005**
RDW-CV (%)	1.378 (1.122-1.692)	**0.002**	1.336 (1.027-1.738)	**0.031**
P-LCR (%)	1.021 (0.969-1.075)	0.437	1.017 (0.960-1.078)	0.565
WBC (×10^3/µL)	0.993(0.893-1.103)	0.894	1.061 (0.941-1.196)	0.332
Hb (g/dL)	0.744 (0.611-0.905)	**0.003**	0.859 (0.660-1.117)	0.257
IG count (×10^3/µL)	1.316 (0.631-2.744)	0.463	0.956 (0.414-4.027)	0.917

AMI = acute myocardial infarctus, RDW-SD = red blood cell distribution width-standard deviation, RDW-CV = red blood cell distribution width- coefficient of variation, WBC = White blood cell, Hb = hemoglobin, IG = immature granulocyte

14.4 (57.8% sensitivity; 90.3% specificity). In their study, Avcı *et al*. [30] showed that WBC values above 10,8 were a strong predictor of mortality with 68.4% sensitivity and 62.5% specificity. In our study, with a cut-off value of 11.4, AUC of 0.827, sensitivity of 85% and specificity of 73%, WBC is an important biomarker of short-time mortality in patients with AMI. It was found to be ineffective in demonstrating 15-month mortality (Tables 3 and 4).

Recently, Dehghani *et al*. [31] investigated a new parameter called WMR as a predictor of long-term outcomes in patients with NSTEMI. They suggested that WMR is a better predictor of worse outcomes than WBC and mean platelet volume (MPV) in patients with NSTEMI. Çiçek *et al*. [9] showed that WMR is a good predictor of long-term mortality in a large number of STEMI patients undergoing primary percutaneous coronary intervention (PPCI) [9]. In our study WMR 1.01 cut-off value, 0.754 AUC value, was shown to be a moderate independent predictor of short-term mortality in patients with heart attack, but it was found to be ineffective in demonstrating 15-month mortality (Tables 3 and 4).

Age was quite impressive in short- and long-term mortality rates after AMI, as demonstrated in the study by Goldberg *et al*. [32]. In a study by Haller *et al*. [33], age was an independent predictor of both short-term and long-term mortality in STEMI patients. In our study, age had a predictive value in both short-term and long-term mortality (Table 3 and 4). In fact, age was the most predictive predictor of long-term mortality in our study.

In a study by Vrsalovic *et al*. [34], low hemoglobin and high CRP values were shown to be predictive markers for short-term mortality in STEMI patients. In another study by Padayachee *et al*. [35], patients with CRP > 3 mg/L were found to be effective in predicting both long-term and short-term mortality. It has been suggested that it increases the risk of death due to coexistence [36]. In our study, although the hemoglobin values of the deceased group in short-term mortality were lower, the predictive feature of hemoglobin was not high enough. CRP, on the other hand, was more successful in predicting short-term mortality than long-term (Tables 3 and 4).

The left shift of the granulocyte shift, which means by the presence of IG, indicates that the bone marrow is active. Based on the cell morphology in IG peripheral smear, it is classified as promyelocytes, myelocytes, metamyelocytes and band forms. However, IG counting is difficult with this way of spreading. However, almost all of today's hemogram analysers measure IG accurately [37].

IG, on the other hand, is a parameter that is little known by physicians and is already measured in many hemogram devices together with other parameters. In other words, it does not require an extra effort, cost and time. Several recent studies have shown that IG can be used to predict short-term mortality [38, 39]. In a recent study, it was shown that IG number predicts mortality in upper gastrointestinal system diseases with a cut-off value of 0.95 with a sensitivity of 66.7% and a specificity of 75.7% [11]. In another recent study, IG predicted mortality in patients with peritonitis with a cut-off value of 1.05 [39]. Similarly, in a study by Korkut *et al*. [21], it was shown that there is a significant relationship between high IG values and mortality in STEMI patients. In this study, IG was shown to be a moderately predictive marker in predicting hospital mortality [21]. In our study, the cut-off point of the IG number was 0.045 and the AUC value of 0.841, and the sensitivity was 92% and the specificity was 62%. The percentage of IG was AUC = 0.806, the sensitivity was 82% with a cut-off point of 0.45 and the specificity was 70%. Both parameters were highly effective in predicting short-term mortality. However, they were ineffective in demonstrating long-term mortality (Tables 3 and 4).

Limitations

Nevertheless, the study presented here has some limitations. It was originally designed as a single-center, retrospective study. In addition, delta IG measurements were not made. These measurements can be much more useful for mortality estimation. Prospective multicenter studies are needed to demonstrate the relationship between AMI and IG.

CONCLUSION

We think that estimating the patient group whose condition is serious from the hemogram blood at the first admission to the hospital will provide clinicians with a serious advantage in terms of managing the treatment of the patients. With this patient group, we be-

lieve that clinicians can reduce mortality rates, perhaps by increasing the number of visits, or by starting effective treatment early. In this context, IG will be very useful for clinicians in the short-term process management of AMI patients, as it does not require extra costs, provides fast results, can be studied even in the smallest laboratories, and has a high predictiveness in predicting mortality after AMI. However, it is ineffective in demonstrating long-term mortality.

Authors' Contribution

Study Conception: SG, NCÇ; Study Design: SG, NCÇ, FMKG; Supervision: SG, NCÇ, FMKG; Funding: N/A; Materials: SG, SA; Data Collection and/or Processing: SG, SA; Statistical Analysis and/or Data Interpretation: SG, NCÇ, FMKG; Literature Review: SG, SA; Manuscript Preparation: SG, SA and Critical Review: FMKG.

Conflict of interest

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

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