Predictive Value of HALP Score in The Early Stage of NSTEMI

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Abstract

Aim: Several inflammatory markers are associated with coronary artery disease severity and worse cardiovascular outcomes. The hemoglobin, albumin, lymphocyte, and platelet (HALP) score are an indicator of inflammation and nutritional status. We aimed to evaluate the practicality of HALP score in non-ST elevation myocardial infarction (NSTEMI) patients.

Methods: This study was designed as a retrospective cohort study. Patients over the age of 18 who have been diagnosed with acute coronary syndrome were retrospectively searched from hospital records. The study groups were formed according to the results of the coronary angiography. Demographic data such as age, gender, total blood count, albumin levels, troponin levels and HALP scores of the patients were analyzed and comparisons between the groups were made decisively.

Results: 201 patients were enrolled in the study and the data was obtained from hospital records retrospectively. 79 patients were excluded from the study due to ST segment elevation myocardial infarction (STEMI). The study population was collected under two groups; the NSTEMI group (n=66) and normal coronary arteries (NCA) group (n=56). The mean age of NSTEMI group was 62.3 ± 11.8 and 71.2% (n=47) was male. The mean age of NCA group was 51.8 ± 9.2 and 30.3% (n=17) was male. There were statistically significant difference between NSTEMI and NCA groups in term of age and gender ($p<0.05$). The HALP score was statistically higher in NSTEMI group compared to NCA group ($p<0.001$). Age and HALP score have explanatory powers on NSTEMI patients ($p=0.001$ and $p=0.022$, in order of).

Conclusions: HALP score may be used as an easily applicable and inexpensive method in clinical practice that can contribute to the early diagnosis of NSTEMI patients.

Keywords: *NSTEMI, emergency department, HALP score*

1. Introduction

Heart disease is among the first causes of death in the world and it causes major health problems and economic difficulties[1]. Acute coronary syndrome (ACS) takes the first place in heart diseases and defines the general of ischemic myocardial disease and includes diagnoses covering ST segment elevation myocardial infarction (STEMI), non-ST elevation myocardial infarction (NSTEMI) and unstable angina pectoris (UAP). There are many events that can cause ACS, but the most common condition in its pathogenesis is plaque rupture and the resulting coronary artery thrombosis.

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NSTEMI is caused by an imbalance in the oxygen supply and demand of the myocardium, which is formed as a result of partial obstruction of the coronary arteries and in this case, subendocardial ischemia and necrosis are observed[2]. This can damage the heart and disrupt its ability to pump blood throughout the body.

NSTEMI can be life threatening and cause lasting damage to the organs and increase the risk of subsequent heart problems. Clinical studies in NSTEMI show that outcomes improve with early invasive intervention. Therefore, early recognition of high-risk patients is of great importance. To date, many biomarkers and risk scores have been used for this reason[3]. The existence of cheap and easily accessible biomarkers is useful and life-saving in the diagnosis and follow-up of patients in NSTEMI, as in many diseases.

According to the conducted studies, inflammation has an important place in the development of atherosclerosis and cardiovascular diseases[4]. Inflammation and oxidative stress can cause plaque rupture, which in turn causes cardiovascular conditions[4]. Inflammatory markers affect the clinical course of coronary artery disease

(CAD) and associated with the occurrence of worse cardiovascular events[5]. Recent studies have also shown that many acute phase proteins (APPs) such as C- reactive protein, albumin are associated with the development of CAD, the severity of CAD, stroke, the presence of peripheral arterial disease and adverse cardiovascular conditions[6]. Anemia, hypoalbuminemia, hypoproteinemia and some mineral deficiencies such as iron and zinc are markers indicating malnutrition. Anemia is also causes cardiac decompensation and increases mortality rates[7]. Lymphocytes have an important role in inflammation. Since high platelet levels cause thromboembolism and atherosclerotic conditions, it has been found that it increases mortality[8]. Besides, white blood cell count to mean platelet volume ratio (WMR), is a marker of inflammation in atherosclerotic diseases and STEMI patients[9].

The HALP score (Hemoglobin, albumin, lymphocyte and platelet score) is an easy-to-measure parameter indicating nutritional condition and systemic inflammation[10] and has been suggested that it is an important prognostic marker in many cancer patients[11], acute heart failure[12], stroke[13] and acute ST elevation myocardial infarction[14]. However, it is unknown whether the HALP score has diagnostic value in terms of early diagnosis and therapy in NSTEMI patients. Therefore, in our study, we aimed to evaluate the predictive worth of the HALP score in patients with NSTEMI.

2. Materials and methods

This study was conducted in the emergency department of a tertiary hospital. Patients over the age of 18 who have been diagnosed with ACS in the emergency department and admitted to the coronary intensive care unit for the purpose of performing coronary angiography within a six-month period were recorded. Demographic data such as age, gender, and ECGs of the patients were analyzed during the emergency department admission.

Hemoglobin, neutrophil, lymphocyte, platelets, albumin and troponin results during the admission were recorded. An automated analyzing device was used for blood counts and analysis of biochemical markers (Cell_Dyn Ruby Hematology Analyzer, Architect c8000 Clinical Chemistry). The HALP score was measured with the hemoglobin (g/L) × albumin (g/L) × lymphocyte count (/L) / platelet count (/L) process10,11.

Patients were grouped into STEMI, NSTEMI and UAP groups according to their ECG and troponin levels at the time of admission. Patients with ST elevation on their ECG and diagnosed with STEMI at the time of admission were excluded from the study. After excluding STEMI patients, the study population was divided into NSTEMI and normal coronary artery (NCA) groups. Patients who did not have ST elevation on ECG and were found to have elevated troponin at the time of admission were included in the NSTEMI group. Patients hospitalized with the diagnosis of UAP were also evaluated according to the results of coronary angiography. Patients hospitalized with the diagnosis of UAP and found to have coronary artery occlusion in their angiography were included in the NSTEMI group. On the other hand, patients hospitalized with the diagnosis of UAP and no coronary artery occlusion detected in angiography were included in the NCA group.

Patients under 18 years of age were excluded from the study.

2.1. Statistical Analysis

Data which for continuous variables with normal distribution are indicated as mean ± standard deviation, for variables which are not normally distributed and as numbers and proportions for categorical variables are indicated as median (interquartile range). The Shapiro-Wilk test was used to determine whether the data showed a normal distribution, and the Levene test was used to assess whether the group variances were homogeneous. Binary logistic regression analysis is used to define the predictive value of risk factors with the ACS. ROC (Receiver operating characteristic) curve was applied to examine the cut-off value, sensitivity and specificity of the HALP score on NSTEMI diagnosis. Analyses of the data are performed using SPSS 20.0 (IBM SPSS Ver. 20.0, IBM Corp, Armonk NY, USA). A p-value of <0.05 is determined statistically significant.

While conducting this study, the Helsinki Declaration was complied with and accepted by the local ethics committee (ESH/GOEK 2022/3).

3. Results

During the 6-month study period, 201 patients who were admitted to the Cardiology Intensive Care Unit for angiography after being diagnosed with ACS were enrolled in the study. 79 patients were excluded from the study due to STEMI. According to the results of angiography, coronary artery occlusion was detected in 66 patients and they were enrolled in the study (NSTEMI) group with the diagnosis of NSTEMI. The remaining 56 patients had normal coronary arteries as a result of angiography and were enrolled in the NCA group (Figure 1).

The mean age of NSTEMI group was 62.3 ± 11.8 and 71.2% (n=47) was male. The mean age of NCA group was 51.8 ± 9.2 and 30.3% (n=17) was male. There were statistically significant difference between NSTEMI and NCA groups in term of age and gender (p<0.05).

No significant difference was seen at hemoglobin, albumin and lymphocyte counts (p>0.05). The troponin levels were higher in NSTEMI group (p<0.001) and platelet count was higher in NCA group (p=0.001).

Figure 1

Flow-chart of the patient selection

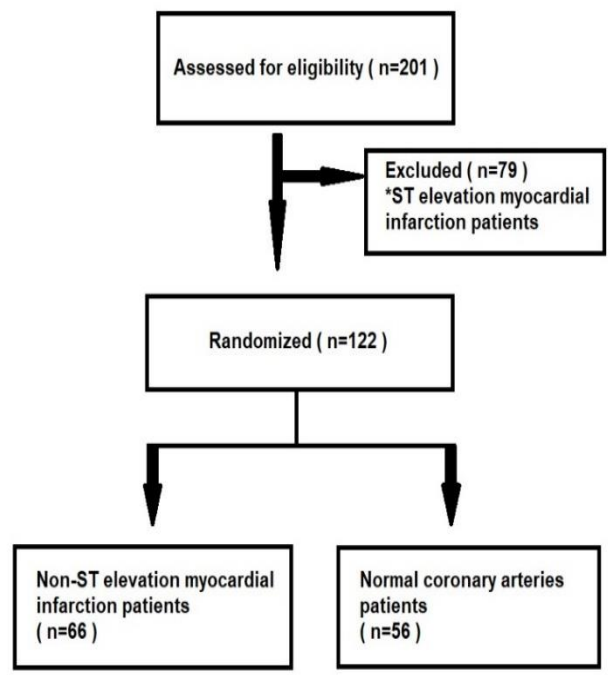


Table 1

Characteristics of the patient groups

	NSTEMI (n=66)	Normal coronary arteries (n=56)	P
Age, year	62.3 ± 11.8	51.8 ± 9.2	<0.001
Gender, male, n (%)	47 (71.2%)	17 (30.3%)	<0.001
Hemoglobin, g/dl	14.2 ± 2.1	13.4 ± 1.8	0.014
Albumin, g/dl	43.6 (40.0 – 45.7)	42.7 (41.0 – 45.4)	0.875
Lymphocyte (*10^3)	2.5 (1.9 – 3.2)	2.8 (1.9 – 2.8)	0.080
Platelet (*10^3)	227.3 ± 57.0	266.3 ± 71.0	0.001
Troponin, ng/l	249.4 (45.5 – 1015.9)	13.6 (1.1 – 39.5)	<0.001
HALP score	7.3 (5.1 – 10.0)	5.1 (3.9 – 6.4)	<0.001

The HALP score was statistically higher in NSTEMI group compared to NCA group (7.3 (5.1 – 10.0) for NSTEMI group and 5.1 (3.9 – 6.4) for NCA group, p<0.001). The main characteristics of the patient groups are shown in Table 1.

The binary logistic regression analysis was used to evaluate the impact of risk factors and laboratory parameters on NSTEMI patients. Age and HALP score have explanatory powers on NSTEMI patients (p=0.001 and p=0.022, in order of) (Table 2).

ROC curve analysis was formed to predict the best cut off value for HALP to predict NSTEMI in patients. The area under the curve was 0.706 which is an acceptable value. Best cut of value was 5.58 with 69.7% sensitivity and 62.5% specificity (Figure 2).

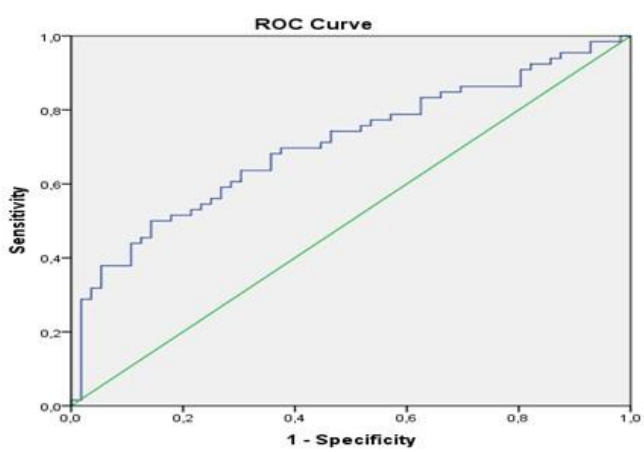
Table 2

Visual acuity and geriatric depression scale results before and after surgery

Variable	Odds Ratio	95% Confidence Interval	P
Age	1.225	1.084-1.384	0.001
Gender	0.131	0.017-1.025	0.053
Troponin	1.002	1.000-1.004	0.054
HALP score	1.854	1.093-3.143	0.022
Constant	0.000		0.002

Figure 2

ROC Curve for HALP Score



4. Discussion

NSTEMI is a life-threatening condition that can cause multiple organ damage if not treated early. For this reason, it needs many early diagnostic and predictive tests. In our study, the diagnostic value of the recently determined HALP score was investigated in NSTEMI patients.

The HALP score was initially described to evaluate survival in gastric cancer[15]. After it has been used to evaluate survival in many cancer types and in patients with ischemic stroke[11,13]. The HALP score is a newly established, valuable marker that provides information about the patient's nutritional status and systemic inflammation. With this marker, the general health status of the patient is evaluated according to hemoglobin, albumin, lymphocyte and platelet values. In recent studies it has been shown that lower HALP score is associated with shorter survival[10,13]. In the study of Cay et al. in patients who had undergone bariatric surgery, it has been found that those with a high HALP score lose weight more easily and the improvement in laboratory values is more significant[16]. With this study, we evaluated the HALP score in NSTEMI patients and this is a first in the literature.

The first of the markers evaluated in the HALP score is hemoglobin value. Anemia is an indicator of poor prognosis in patients with CAD, including NSTEMI[17]. Similar results were found in many studies in the literature. But, we did not find a statistically significant difference in terms of hemoglobin level between NSTEMI group and NCA group in this study.

The second parameter of the score is albumin, which is present in the intravascular space as the main protein. Albumin has an important role in many physiological functions. In addition, a decrease in serum albumin may lead to an increase in poor clinical outcomes in coronary artery disease (CAD)[18]. In our study, we found the serum albumin result of patients with NSTEMI to be higher than the level of NCA, but there was no statistically significant difference.

Lymphopenia is a parameter that can be an indicator of a poor prognosis in CAD patients[19]. In our study, we found the lymphocyte level, which is the third marker of HALP score, higher in patients with NCA compared to NSTEMI patients, but no statistically significant difference was found.

Platelets have a very important place in the formation of ACS. Both high and low platelet counts can be seen in CAD. Some studies have found that increases in platelet levels lead to thromboembolism and atherosclerotic conditions, and these conditions cause an increase in deaths due to CAD[20,21]. However, studies conducted on intensive care patients have shown that a low platelet count worsens the prognosis of patients and increases mortality[22]. Also low platelet levels are also used to predict poor clinical results in patients with ACS[23]. In our study, the platelet level, which is the fourth marker, was detected lower in NSTEMI patients and there was statistically significant difference.

Studies have established that the HALP score can indicate the nutritional-inflammation condition of patients[10,24] and has been proven that it is an important prognostic marker for patients with cancer[25]. There are limited studies in which the HALP score has been evaluated in non-cancer cases. In a study conducted by Kocaoğlu et al.[26], in intensive care patients, the utility of HALP score to estimate mortality was examined and the HALP score was not found to be good predictor of prognosis in intensive care patients. In another study conducted by Kocaoglu et al.[12], HALP score and modified HALP (m-HALP) score were evaluated in patients with acute heart failure and it was found that the m-HALP score is more important predictor in determining the 3-month mortality in patients with acute heart failure. On the other hand, it was found that the classical HALP score was not statistically significant. In a study

conducted by Tian et al.[13], in acute ischemic stroke (AIS) patients, the relationship between HALP score and poor clinical conditions was examined and found that HALP score can be an important indicator of death and recurrent stroke in patients with AIS. In a study conducted by Karakayalı et al.[14], in STEMI patients undergoing primary percutaneous coronary intervention, the HALP score was found to be a significant independent predictor of in-hospital mortality. In our study, HALP score at admission was found higher in NSTEMI patients and there was statistically significant difference.

Limitations

The major limitation of our study is the small sample size. Also, the retrospective design of the study caused us not to be able to access the data of some patients.

5. Conclusion

Our study proved that, the HALP score is an easily applicable and inexpensive method in clinical practice that can contribute to the early diagnosis of NSTEMI patients. Although these findings are not sufficient to apply in a clinical approach according to current guideline recommendations, future studies on similar subjects and increased data may change future practices.

Statement of ethics

The study was approved by the local ethics committee (ESH/GOEK 2022/3).

Conflict of interest statement

The authors declare that they have no financial conflict of interest with regard to the content of this report.

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Contribution Details

Göknur Yıldız: Design, Literature search, Data acquisition, Manuscript preparation, Manuscript editing, Manuscript review, Guarantor

Fatih Alper Ayyıldız: Design, Data acquisition, Manuscript preparation, Manuscript editing, Guarantor

Özge Turgay Yıldırım: Design, Data analysis, Statistical analysis, Manuscript editing

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