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Kardiyak Göğüs Ağrısı ve Akut Koroner Sendrom Şiddeti Ayırıcı Tanısında MPV ve Platelet/MPV Oranının Rolü

Role of MPV and Platelet/MPV Ratio in The Diagnosis of Cardiac Dilemma; Cardiac or Non-Cardiac Chest Pain, and Severity of Acute Coronary Syndrome

Onur Karakayalı[1], Serkan Yilmaz[2], Anıl Karakayalı[3], Serdar Bozyel[4]

1Sağlık Bilimleri Üniversitesi, Kocaeli Derince Eğitim ve Araştırma Hastanesi, Acil Tıp Kliniği, Kocaeli, Türkiye
2Kocaeli Universitesi, Kocaeli Üniversitesi Tıp Fakültesi, Acil Tıp Kliniği, Kocaeli, Türkiye
3Sağlık Bilimleri Üniversitesi, Kocaeli Derince Eğitim ve Araştırma Hastanesi, İç Hastalıkları Kliniği, Kocaeli, Türkiye
4Sağlık Bilimleri Üniversitesi, Kocaeli Derince Eğitim ve Araştırma Hastanesi, Kardiyoloji Kliniği, Kocaeli, Türkiye

ÖZ

GİRİŞ ve AMAÇ: *Acil servise başvuran hastalarda akut koroner sendrom ve kardiyak / kardiyak olmayan göğüs ağrısının ayırıcı tanısı ile kritik vaskuler stenozun öngörülmesinde mortalite üzerine bağımsız bir belirteç olarak mean platelet volum (MPV) ve trombosit / MPV oranının etkinliğini araştırmak.*

YÖNTEM ve GEREÇLER: *Retrospektif gözlemsel çalışmaya göğüs ağrısı ile acil servise başvuran 45 yaş ve üstü hastalar dahil edildi. Hastalar kardiyak / kardiyak olmayan göğüs ağrısı olarak gruplara ayrıldı. MPV, trombosit/ MPV oranı, koroner anjiyografi sonuçları, hastane içi ve 1 aylık hastane mortalitesi kaydedildi.*

BULGULAR: *Çalışmaya katılan 753 hastanın %37,46'sında kardiyak patoloji tespit edildi. Tüm hastaların yaş ortalaması 60,1 ve tüm hastaların % 59'u erkekti. Kardiyak ve kardiyak olmayan hastalar arasında trombosit, Mean platelet volum (MPV) ve trombosit / MPV değerleri açısından istatistiksel olarak anlamlı bir fark saptanmıştır (sırasıyla p = 0.005, p <0.001 p <0.001).MPV, trombosit / MPV değerlerinin majör kardiyak advers olay gelişimini gösteren ROC eğrisi; eğri altında kalan alan MPV için 0.677 ve trombosit / MPV için 0.366 olarak bulunmuştur. Major kardiyak olay görülen hasta grubunda STEMI olan hastalara göre, STEMI-AKS olmayan hastalarda ortalama MPV değeri istatistiksel olarak anlamlı derecede düşüktü (p = 0.003). Kritik stenoz saptanmayan hastalara göre MPV değeri istatistiksel olarak anlamlı derecede yüksek ve ortalama trombosit / MPV değeri istatistiksel olarak anlamlı derecede düşüktü (p≤0.001).*

TARTIŞMA ve SONUÇ: *MPV ve trombosit düzeyinin tek başına kullanımlarının yetersiz olmasına rağmen, literatürde açıklanan diğer risk faktörleri ile birlikte kullanıldığında akut koroner sendrom tanısı için bağımsız belirteçler olarak kullanılabileceğini düşünmekteyiz.*

Anahtar Kelimeler: *acil servis, mpv, göğüs ağrısı*

ABSTRACT

INTRODUCTION: *We aimed to investigate effectiveness of mean platelets volume (MPV) and platelet/MPV ratio as an independent marker on mortality for prediction of critical vascular stenosis in the differential diagnosis of acute coronary syndrome and cardiac/non-cardiac chest pain in patients presenting to the emergency department.*

METHODS: *Retrospective observational study included patients of 45 years of age and above presented to the ED with chest pain. Patients were divided into groups with cardiac/non-cardiac chest pain. MPV, platelets/MPV ratio, coronary anjıography results, in-hospital and 1-month hospital mortality were recorded*

RESULTS: *A total of 753 patients; Cardiac pathology was determined in 282 (37.46%). The mean age was determined as 60.1 years and 59% were male. A statistically significant difference was detected between cardiac and non-cardiac patients with regard to platelet, MPV and plt/MPV values (p=0.005, p<0.001 p<0.001, respectively)*

DISCUSSION and CONCLUSION: *Although MPV values and platelet/MPV ratio are not sufficient to use alone in routine daily practice, we consider that MPV and the platelets/MPV ratio are significant as dependent markers for the diagnosis of ACS when used together with the other described risk factors in the literature.*

Keywords: *emergency department, mean platelet volume, chest pain*

İletişim / Correspondence:
Dr. Onur Karakayalı
Sağlık Bilimleri Üniversitesi, Kocaeli Derince Eğitim ve Araştırma Hastanesi, Acil Tıp Kliniği, Kocaeli, Türkiye
E-mail: dr_onurkarakayali@hotmail.com
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INTRODUCTION

Acute coronary syndrome (ACS) is among the first leading causes of death worldwide. Many etiologic factors have been defined and platelets are known to play a role in pathogenesis of atherosclerosis and ACS (1). Platelet size affects activation, and in particular, large platelets are metabolically and enzymatically more active than small platelets also produce more trombaxane (2). Under the light of these data, platelet hyper-activation and local platelet activation are the main pathogenesis in ACS (3). The mean platelet volume (MPV) is the main marker for platelet size and potential platelet activation. Although measuring the platelet activation through one of the methods may define the individuals cardio-vascular risk, they could not be included in the routine clinical decision making process yet. The most important potential cause is absence of an optimal cut-off value. The prognostic importance of platelets in ACS has been well studied in acetylsalicylic acid, which inhibits platelet activation and with novel anti-aggregant drugs; however, the diagnostic and predictive role of activated platelets has been less defined in ACS (4).

MPV shows a borderline alteration in the differential diagnosis of acute myocardial infarction (AMI) and unstable angina pectoris (USAP). Studies report that additional studies conducted with larger sample size are required (5). Conventional methods are not sufficient for defining the risk of thrombosis after percutaneous coronary intervention (PCI) in ACS patients who undergo PCI, and elevated troponin values have been reported not to be sufficient alone as a risk factor in stent thrombosis (6). Although many laboratory parameters and clinical scoring systems have been defined for prediction of in-hospital and out-of-hospital mortality, the current parameters are not sufficient alone for prediction of mortality.

ACS is among the first leading fatal causes of chest pain and it should be promptly and accurately managed by the clinicians. Troponin is used as a cardiac marker when electrocardiogram (ECG) is not diagnostic however, easy and fast cost-effective additional laboratory tests are required as this laboratory test takes a long time, has a low diagnostic value within the first 12 hours, and yields negative results in 14-20% of the patients (7). Apart from the cardiac markers, the platelet count and MPV measurement are the most studied parameters for the clinical diagnosis. Most of the clinical studies compare ACS patients with healthy volunteers (8) and sufficient studies are not available for the differential diagnosis of cardiac and non-cardiac chest pain in emergency department (ED).

We aimed to investigate the effectiveness of MPV and platelet/MPV ratio as an independent marker on mortality for prediction of critical vascular stenosis in the differential diagnosis of ACS and cardiac/non-cardiac chest pain in patients presenting to the ED.

METHODS

Study design and population

This was a single center, retrospective, observational study, conducted with patients presenting to the ER of a tertiary hospital between 01 January 2017 and 01 June 2017. The patient files were screened through the ICD codes of "chest pain", "chest pain, unspecified" and "chest pain, others". Ethics Committee Approval of the study was taken from the local ethics committee. (Protocol: KOU GOKAEK 2018/207).

Participants

Patients of 45 years of age and above, who had presented to the ED with chest pain were included. The patients were divided into two groups with cardiac and non-cardiac chest pain. The patients were classified as ST-elevation myocardial infarction (STEMI) and non-ST segment elevation ACS (Non-STEMI ACS) in accordance with the 2014 American Heart Association Guidelines. Patients who had ischemic type chest pain on admission, those who did not have serial cardiac enzyme follow-up alteration; however, those who had ischemic type ECG alteration following anti-aggregant and nitrate infusion were accepted as USAP. Patients who did not have an ECG alteration for at least 12 hours, those whose serial cardiac enzymes (troponin I, creatinine kinase-MB (CK-MB), myoglobin) were not elevated, those who did not have wall movement disorder or ischemic changes on exertion test were evaluated as non-cardiac chest pain. Patients below 45 years of age, hepatic or renal insufficiency, myelo-proliferative disorder, malignancy, trauma-related chest pain, myocardial infarction within the previous 8 weeks,

using oral anti-coagulant, could not be reached in the one-month follow ups and whose patient records could not be reached were excluded from the study.

Study Protocol

According to the AHA Guideline, patients who had cardiac chest pain were classified as major adverse cardiac event positive (MACE+) and patients with non-cardiac chest pain were classified as major adverse cardiac event negative (MACE-). The archive records or admission data in the data processing system were reached and demographic data, medical histories were recorded. Age, gender, diabetes mellitus, previous coronary artery disease, hyperlipidemia, obesity and smoking status were recorded as risk factors. MPV, platelet count, creatine kinase-MB (CK-MB), the troponin I values within the first 2 hours after admission, and the cardiac enzyme values at every 3 hours were recorded from the patient files.

All patients with cardiac chest pain underwent coronary angiography and PCI within the first 2 hours. Patients who had more than 70% coronary artery stenosis or for whom a coronary artery bypass operation was decided after angiography were classified as "critical vascular stenosis"; patients who had less than 70% coronary artery stenosis or who did not have a proximal stenosis in the main vessel were classified as "non-critical vascular stenosis" and patients whose vessels were normal or who had non-critical plaque were classified as "normal".

Follow up

The patients were reached through epicrisis records and phone numbers, hospital follow-ups and one-month follow-ups were carried out. Patients who had died, those who had undergone angiography following current in-stent thrombosis or those for whom a coronary artery bypass after angiography was decided, were recorded. Re-admission, presence of in-stent thrombosis and mortality were inquired through phone calls. Re-admission of the patients who had presented with non-cardiac chest pain and discharged, and diagnosed with a cardiac disease on re-admission were analyzed.

Primary outcome: To evaluate the effectiveness of MPV in the differential diagnosis of cardiac and non-cardiac chest pain in patients presenting to the ED due to chest pain

Secondary outcome: To evaluate the effectiveness of MPV level in mortality and stent thrombosis in critical vascular stenosis and one-month follow-up of patients determined to have ACS and undergoing PCI.

Statistical Analyses

The data obtained from the patients were evaluated using SPSS version 21.0 (SPSS Inc. Chicago, USA) for Mac. Sociodemographic and clinical features of the patients were expressed through the mean ± standard deviation, median, interquartile range (IQR), 95% confidence interval (CI), and percentage (%). A Student's t-test was used for the comparison of the continuous variables, and the chi-square test was utilized for the comparison of the discrete variables. Normal or abnormal distribution of MPV values was tested by means of the Kolmogorov-Smirnov test. An independent t-test was used to evaluate the comparison between the serum MPV values of the MACE (+) group and the MACE (-) group. A receiver operating characteristic (ROC) curve was constructed to determine the test characteristics (sensitivity and specificity) of MPV. Youden's index was used to select the best cut-off values for MPV levels. Histogram is used to asses the normality. Delog test is used to compare the results with ROC curve of AUC. The area under the curve (AUC) was calculated for MPV's ability to predict MACE with MedCalc programme. Positive and negative likelihood ratios were also calculated. Statistical significance was set at $p < 0.05$. All results were reported along with their associated 95% CIs and p-values.

RESULTS

Patients who had presented with isolated chest pain during the 6-month period beginning from January 2017 were included in the study. During study period a total of 1158 patients with chest pain were evaluated. 270 patients with non-cardiac chest pain, 32 patients whose files could not be reached, 61 patients without serial cardiac enzymes and ECG follow-up and 42 patients who could not be reached from the communication numbers were excluded from the study. A total of 753 patients were evaluated according to clinical, laboratory and echocardiography findings. Non-cardiac pathology was determined in 471 (62.54%) (MACE -), and

cardiac pathology was determined in 282 (37.46%) (MACE +). The mean age was determined as 60.1 years (95% CI:59.4-60.9). 456 of the patients (59%) were male.

The baseline demographic characteristics, cardiac risk factors and vital signs on admission have been summarized in Table 1. No statistically significant difference was found between the patients with regard to risk factors and baseline vital signs.

Table 1. Baseline Demographics Characteristics of Study Group

	All Patients n=753	Cardiac Chest Pain n= 322	Non-cardiac Chest Pain n= 431	P value
Demographics				
	456 (60.6)	200 (62.1)	256 (37.9)	0.49
Age m, (%95CI)	60.1 (59.4-60.9)	61.3 (60.2 - 62.4)	59.2 (58.3 - 60.2)	0.07
Sex (M) n, (%)	456 (60.6)	200 (62.1)	256 (59.4)	0.498
Family History n (%)	178 (23.7)	107 (24.7)	74 (23.1)	0.68
Hypertansion n (%)	523 (69.5)	226 (70.2)	295(68.4)	0.64
Diabetes Mellitus n (%)	278 (36.9)	116 (36)	166 (38.6)	0.52
Hipercholestrolemia n (%)	174 (23.1)	70 (21.7)	104(24.1)	0.78
Obesity (BMI>30) n (%)	93 (12.4)	45 (14)	48 (11.1)	0.32
Smoking n (%)	110 (14.7)	42 (13.1)	76 (17.7)	0.13
Vital Signs				
Pulse Rate m, (SD ±)	99.8 (21.4)	90 (21.2)	100.4 (21.4)	0.161
SBP m, (SD ±)	130.7 (29.3)	138.5 (34.6)	130.2 (29.6)	0.408
Temperature m, (SD ±)	36.3 (0.7)	36.1 (0.4)	36.3 (0.7)	0.100
SPO2 m, (SD ±)	93.8 (5.9)	94.7 (4.8)	93.8 (6.1)	0.639
Respiratory Rate m, (SD ±)	25.4 (5.6)	25.4 (5.6)	25.2 (5.6)	0.903

m: mean, SD±: Standart Deviasyon, M:Male , BMI: Body Mass İndex, SBP: Sistolic Blood Pressure, SPO2: Saturation

The laboratory data on admission have been summarized in Table 2. A statistically significant difference was detected between MACE (+) and MACE (-) patients with regard to platelet, CK-MB, Troponin I, MPV and plt/MPV values (p=0.005, p<0.001, p<0.001 and p<0.001, respectively).

Table 2. Value of MPV, Plt/MPV, Platelets, CK-MB and Troponin between the cardiac and non-cardiac chest pain

	All Patients n=753	Cardiac Chest Pain n= 322	Non-cardiac Chest Pain n= 431	P value	mdf	%95 CI
Platelet m, (%95CI)	244553 (239653 – 249453)	236459 (228657 – 244262)	250601 (244366 – 256836)	0.005	-14140	(-24000) – (-42800)
CK-MB M, (IQR)	2.2 (0.92 – 5.6)	6.19 (3.1 – 16)	1.11 (0.57 – 1.91)	< 0.001	5.66	4.67 – 6.65
Troponin M, (IQR)	0.027 (0.010 – 0.92)	1.30 (0.42- 5.39)	0.010 (0.010 – 0.010)	< 0.001	1.30	1.02 – 1.58
MPV m, (%95CI)	7.51 (7.42 – 7.62)	7.99 (7.81 – 8.16)	7.17 (7.07 - 7.26)	< 0.001	0.89	0.70 – 1.07
Plt/MPV m, (%95CI)	33.8 (32.8-34.6)	30.8 (29.6 – 32.1)	35.9 (34.9 – 37)	< 0.001	-5.14	-6.78 – -3.50

m: mean, M: median, %95CI: %95 Confidence Interval , plt: platelet, MVP: mean platelet volume, mdf: mean difference

The ROC curve, which plots MACE estimation of MPV, Plt and Plt/MPV values have been demonstrated in Figure 1. AUC was found as 0.677 (95% CI: 0.642-0.710) for MPV, 0,571 (95% CI: 0,535-0,607) for plt and 0.634 (95% CI:0.598-0.668) for Plt/MPV. Cardiac pathology was determined in 28 patients (5.91%) on re-admission on one-month follow-ups of the patients who were recorded to have a non-cardiac pathology on the first admission. On the first admission, the mean MPV values were determined as 7.54 95% CI (7,32-7,76), and the mean platelet values were

determined as 230060 95% CI (210000-285000). When the patient group that was determined to have cardiac pathology on re-admission was compared with the (MACE -) patient group, the MPV level was statistically significantly higher (p=0.039). Critical vascular stenosis was determined in 7 patients and non-critical vascular stenosis was determined in 21 patients on angiography. The MPV level was determined as 7.65 95%CI (7,52-7,79) in the critical vascular stenosis group and there was a statistically significant difference when compared to the non-cardiac patient group (p=0.01).

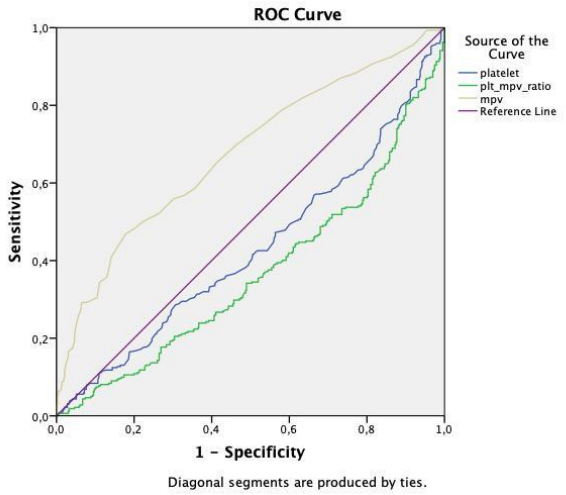

Figure 1. *ROC curve of MPV, plt and pltMPV ratio with cardiac chest pain patients*

In the assessment of MACE + patients, the mean MPV value was statistically significantly low in patients with Non-STEMI-ACS (p=0.003, mean df:-0.5, 95% CI:-0.9-0.2) compared to the patients with STEMI, and the mean Plt/MPV value was statistically significantly higher (p=0.010, mean df:3.47, 95% CI:0.9-6.1). The same relationship was determined between the patients who had undergone PTCA and determined to have critical coronary stenosis and the patients who did not have a critical coronary stenosis. The mean MPV value was statistically significantly higher in patients with critical stenosis compared to the patients who did not have a critical stenosis (p≤0.001, mean df:1.1, 95% CI:0.7-1.4), and the mean Plt/MPV value was statistically significantly lower in patients with critical stenosis compared to the patients who did not have a critical stenosis (p≤0.001, mean df:-4.9, 95% CI:-7.6-2.3) (Table 3). In 5 patients (%0,6) mortality was observed after 1 month follow-up. The mean MPV of patients with mortality was 9.2 %95 CI (8,91-9,65), and the plt / MPV ratio was 31,8 95% CI (28,21-33,87). Although there was no statistically significant difference in plt/MPV ratio (p=0,084), there was statistically significant difference in MPV values of the patients with mortality compared to the other patients (p = 0.002).

The ROC curves, which indicate the performance of MPV and Plt/MPV values for detection of critical stenosis in STEMI and PTCA have been presented in Figure 2 and figure 3. AUC was determined as 0.568 (95% CI:0.509-0.625) in the MPV measurement for STEMI, 0,569 (95% CI: 0,510-0,627) for plt and 0.581 (95%CI:0.523-0.639) in the plt/MPV measurement. AUC was determined as 0.695 (95% CI: 0.640 - 0.746) in the MPV measurement for detection of patients with critical stenosis, 0,548 (95% CI: 0,490-0,605) for plt and 0.628 (95% CI: 0.571 - 0.682) in the Plt/MPV measurement. The sensitivity, specificity, negative predictive value (NPV), positive predictive value (PPV) , positive likehood ratio (LR +), and negative likehood ratio (LR-) values for different cut-off values of MPV and Plt/MPV have been displayedinTable4.

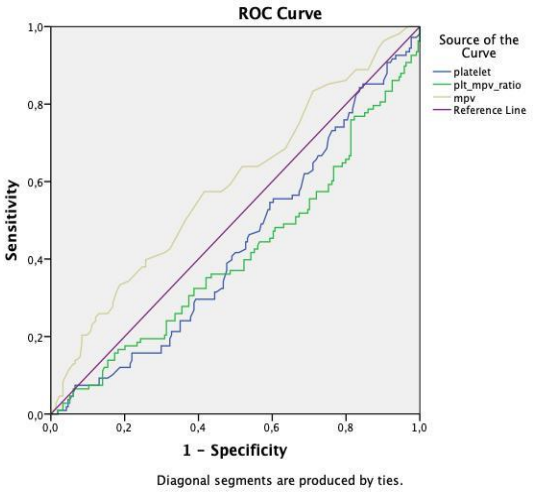

Figure 2. ROC curve of MPV, plt and pltMPV ratio for patients with STEMI

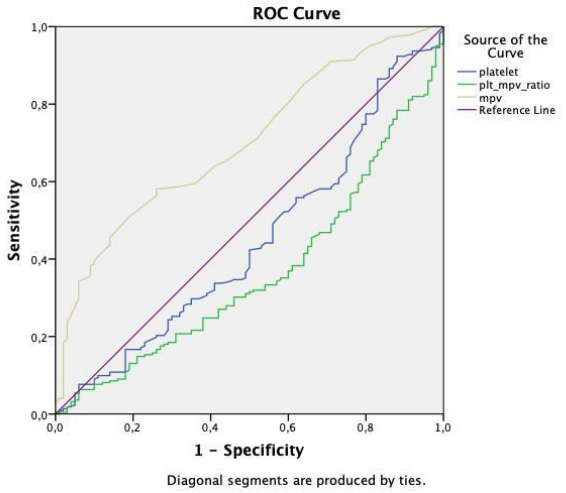

Figure 3. ROC curve of MPV, plt and pltMPV ratio for patients with critical stenosis

DISCUSSION

The present study has revealed that the elevation in MPV values and the decrease in platelet levels are significant in cardiac chest pain compared to non-cardiac chest pain. In addition, MPV level was shown to be higher in NSTEMI compared to USAP patients. There was a direct proportion between critical vascular stenosis and the MPV level in patients who had undergone percutaneous intervention and the mortality, and the stent re-stenosis rates were higher in patients with high MPV in the one-month follow-ups.

While chest pain is among the most common causes of ER admissions, rapid and reliable parameters are required, particularly in cardiac type chest pain. The vast majority of the patients are classified as non-cardiac according to pain characteristics and they are discharged. However 2-8% of these patients have been determined to have been misdiagnosed (9). In our study, low MPV levels and low troponin levels were observed to be more sensitive in the detection of non-cardiac chest pain. Taskesen et al. have revealed that low MPV and low troponin levels indicate low probability of a coronary disorder (10). In the same study, a high MPV level, a high MPV/Plt ratio, advanced age and low platelet level were shown to be significant in critical coronary artery disease. The MPV value was reported to be significant in determination of cardiac chest pain when used in combination with the troponin level (8,11-14). The main limitation of these studies is including healthy volunteers, and not being conducted for the differential diagnosis of patients with chest pain. While our study has the significance of having been conducted with patients presenting to the ER with chest pain, we determined that elevated MPV and low platelet/MPV ratio were statistically significant in the differential diagnosis of cardiac and non-cardiac chest pain, although it has low sensitivity and specificity. Despite these significant results, it does not seem sufficient to be used in daily practice as sensitivity was found as 41% and specificity as 85.8% when MPV>8 was taken as the cut-off value. We think that the main causes include MPV being affected by any factors, the control group not including healthy volunteers, diseases or additional pathologies that could affect the MPV level not having been defined in the non-cardiac patient group, and absence of laboratory standardization. Luca et al. reported that MPV was not directly associated with platelet aggregation and not correlated with the severity of coronary artery disease (15).

The main goal in ACS is to prevent myocardial injury and to eliminate stenosis with urgent intervention. Conventional methods (cardiac markers, echocardiography) are usually insufficient showing severity of vascular stenosis and disease mortality due to the fact that thrombus load cannot not be clearly defined. Previous studies have revealed that large platelets are metabolically and enzymatically more active than small platelets, and large platelets have been shown to inhibit prostacyclin aggregation through having more affinity for ADP receptors and play a role in pathogenesis (16). Large platelets are considered to be proportional to the thrombus load and MPV levels have been suggested to be used in predicting critical and non-critical vascular stenosis in acute coronary syndromes. In our study, the MPV level was found to be significantly higher in patients with critical vascular stenosis compared to those with non-critical stenosis in ACS.

The one-year mortality of ACS has been reported as 12%, and the in-stent thrombosis rate has been reported as 1% during the first one month after PCI (17). In a meta-analysis including 3184 AMI patients, the mortality rate was shown to be higher in patients with higher MPV values, and the mortality risk was shown to increase 2-fold when the cut-off value of MPV was taken as 10.3 compared to 9 (18).

Table 3. Comparison of MPV and Plt / MPV values in patients with STEMI and NSTE-ACS

	STEMI (n= 108)	NSTE – AKS (n=214)	P value	Mean df	%95 CI
MPV n, (%95 CI)	8.4 (8.1 – 8.7)	7.8 (7.6 - 8.1)	0.003	-0.5	- 0.9 – -0.2
Plt/MPV n, (%95 CI)	28.5 (26.4 – 30.6)	31.9 (30.4 – 33.5)	0.010	3.47	0.9 – 6.1
	Critical stenosis (n=222)	Non-critical stenosis (n=100)	P value	Mean df	%95 CI
MPV n, (%95 CI)	8.4 (8.2 – 8.6)	7.3 (7.1 - 7.5)	< 0.001	1.1	0.7 – 1.4
Plt/MPV n, (%95 CI)	29.3 (27.8 – 30.7)	34.2 (32.0 – 36.5)	< 0.001	-4.9	-7.6 – -2.3

STEMI: ST Elevation myocardial infarction , NSTE ACS: NonST Elevation myocardial infarction, df: difference, CI: Confidence interval, MPV: mean platelet volume, Plt/MPV: Platelet/Mean platelets volume ratio

Table 4. Different cut-off values of MPV and Plt / MPV ratios for MACE, STEMI and critical coronary stenosis

MACE	**Sensitivity %**	**Spesificity %**	**PPV %**	**NPV %**	**LR +**	**LR -**
MPV>6.5	88.2	23.2	46.2	72.5	1.15	0.51
MPV>7	75.2	53.6	51.2	71.4	1.62	0.46
MPV>7.5	55.9	69.8	58.1	67.9	1.85	0.63
MPV>8	41	85.8	68.4	66.1	2.89	0.69
Plt/MPV>20	83.9	6.3	40.1	34.2	0.90	2.55
Plt/MPV>25	68	14.2	37.2	37.2	0.79	2.25
Plt/MPV>30	51.2	29	35	44.3	0.72	1.68
Plt/MPV>30	31.7	51.5	32.8	50.2	0.65	1.33
STEMI	**Sensitivity %**	**Spesificity %**	**PPV %**	**NPV %**	**LR +**	**LR -**
MPV>6.5	90.7	13.1	34.5	73.7	1.04	0.71
MPV>7	83.3	29.0	37.2	77.5	1.17	0.58
MPV>7.5	63.9	48.1	38.3	72.5	1.23	0.75
MPV>8	50.0	63.6	40.9	71.6	1.37	0.79
Plt/MPV>20	78.7	13.6	31.5	55.8	0.91	1.57
Plt/MPV>25	57.4	26.6	28.3	55.3	0.78	1.60
Plt/MPV>30	42.6	44.4	27.9	60.5	0.93	1.29
Plt/MPV>35	25.9	65.4	27.5	63.6	0.75	1.33
Critical stenosis	**Sensitivity %**	**Spesificity %**	**PPV %**	**NPV %**	**LR +**	**LR -**
MPV>6.5	92.8	22.0	72.5	57.9	1.19	0.33
MPV>7	81.5	39	74.8	48.8	1.34	0.47
MPV>7.5	63.1	60.0	77.8	42.3	1.05	0.45
MPV>8	50.9	81.0	85.6	42.6	2.67	0.60
Plt/MPV>20	80.6	9.0	66.3	17.3	0.89	2.15
Plt/MPV>25	62.2	19.0	63.0	18.4	0.77	1.99
Plt/MPV>30	44.6	34.0	60.0	21.7	0.68	1.63
Plt/MPV>35	27.0	58.0	58.8	26.4	0.64	1.26

PPV: Positive predictive value, NPV: Negative predictive value, LR+: Positive likelihood ratio, LR-:Negative predictive value

The association with mortality has most frequently been defined in patients with STEMI (19), but the relationship between MPV and mortality has not been well defined in Non-STEMI. Although a directly proportional relationship was determined with MPV in Non-STEMI patients, the small number of patients is the main limitation, which leads to requirement for studies conducted with larger number of patients. In the meta-analysis of Chu et al., a direct association was demonstrated between the MPV level and in-stent thrombosis in 430 patients (6). Despite all this evidence, although it was shown that there was no direct proportion with the MPV level for providing re-perfusion, the small sample size reduced the evidence level (20). Kaushansky et al. indicated that a low platelet level was not statistically significant in non-STEMI and STEMI cases, while it was significant in mortality (21). In many studies, the platelet level is shown to decrease due to the decrease in small platelets for preserving constant platelet volume, together with the elevations in the MPV level (22). Under the light of these data, the MPV/platelet ratio has been shown to be able to be used as a marker for long-term mortality in non-STEMI (23). In our study, elevated MPV and low platelet level were shown to be proper for use as a marker for prediction of short-term mortality and in-stent thrombosis, similarly to the other studies.

LIMITATIONS

Being retrospective and single center, and conducted in a 6-month period, are the main limitations of our study. Patients whose diagnoses were entered with different ICD codes and who had chest pain, could not be determined. Standardization with other studies could not be carried out as the MPV level was examined with different devices. The MPV level being affected by ethnicity, chronic diseases, habits (diabetes, obesity, smoking, inflammatory bowel disease, and directly by aspirin and other anti-coagulant use lead to this limitation. For prevention of these limitations, patients in both groups were analyzed for risk factors such as age, smoking, diabetes and obesity; however, no significant difference was determined. Having knowledge about the final status of the patients in the cardiac and non-cardiac groups, who could not be reached on the follow-ups, is suggested to affect the results; however, this patient group being less than 10%, does not directly affect the statistical significance of the study.

CONCLUSION

The present study has aimed to detect the feasibility of MPV and platelet level as a marker in the differential diagnosis of cardiac and non-cardiac patients, in short term mortality and in-stent thrombosis, for prediction of critical vascular stenosis in the cardiac patient group, and the MPV and low platelet were observed to be significant in all three groups. Although a statistically significant difference was found, finding the sensitivity to be lower than that of the other studies indicates that they are not sufficient to use alone in routine daily practice despite these significant results. In conclusion, we consider that MPV and the platelet level are significant as dependent markers for the diagnosis of ACS and mortality when used together with the other described risk factors in the literature.

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