Association of Platelet-to-Lymphocyte Ratio With Severity and Complexity of Coronary Artery Disease in Patients With Acute Coronary Syndromes

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The SYNTAX score (SXscore) is an anatomic scoring system based on coronary angiography (CA) that not only quantifies lesion severity and complexity but also predicts poor cardiovascular outcomes, including mortality, in patients with acute coronary syndromes (ACS). Recent studies have shown that platelet-to-lymphocyte ratio (PLR) is associated with worse outcomes in many cardiovascular diseases. The aim of this study was to investigate the association of PLR with the severity and complexity of coronary atherosclerosis as assessed by the SXscore in patients with ACS who underwent urgent CA. A total of 1,016 patients with ACS who underwent urgent CA were included in the study from August 2012 to March 2014. Admission PLR values were calculated before CA was performed. The SXscore was determined from baseline CA. The patients were divided into 2 groups, those with low SXscores (≤22) and those with intermediate to high SXscores (≥23). PLRs were significantly higher in patients with intermediate to high SXscores compared with those with low SXscores ($p < 0.001$). In-hospital mortality was significantly higher in the groups with high PLR and intermediate to high SXscores. In multivariate analysis, the independent predictors of intermediate to high SXscore were PLR (odds ratio 1.018, 95% confidence interval 1.013 to 1.023, $p < 0.001$) together with the left ventricular ejection fraction (odds ratio 0.935, 95% confidence interval 0.910 to 0.960, $p < 0.001$), and age (odds ratio 1.029, 95% confidence interval 1.029 to 1.054, $p = 0.02$). A PLR ≥116 had 71% sensitivity and 66% specificity in predicting intermediate to high SXscore. In conclusion, the PLR at admission is significantly associated with the severity and complexity of coronary atherosclerosis in patients with ACS. Increased PLR is an independent predictor of higher SXscore in patients with ACS who undergo urgent CA. **(Am J Cardiol 2014;114:972−978)**

Acute coronary syndromes (ACS) consist of ST-segment elevation ACS (STEACS) and non−ST-segment elevation ACS (NSTEACS). The burden of coronary atherosclerosis is closely associated with prognosis in ACS.[1] The SYNTAX score (SXscore) is an angiographic scoring system based on the severity and complexity of coronary lesions.[2] The SXscore has been shown to be able to predict mortality and morbidity at early and late follow-up in patients irrespective of disease severity in different clinical situations, including ACS.[3−9] Previous studies demonstrated an association between major adverse cardiovascular outcomes and higher platelet and lower lymphocyte counts.[10−14] The platelet-to-lymphocyte ratio (PLR) has recently been investigated as a new inflammatory marker and predictor of major adverse outcomes in various cardiovascular diseases.[15−17] PLR is a significant independent predictor of long-term mortality after NSTEACS.[18] In our recently published study in this journal, high preprocedural PLRs were found to be significant and independent predictors of no reflow in patients with STEACS.[19] Because it is well known that inflammatory response is closely associated with the pathogenesis of coronary atherosclerosis, we aimed to investigated the usefulness of PLR in predicting severity and complexity of coronary atherosclerosis as assessed by the SXscore in patients with ACS who underwent urgent coronary angiography (CA).

Methods

From July 2012 to March 2014, consecutive patients who were hospitalized at our institution because of ACS, who underwent urgent CA after diagnosis, were enrolled in our study.

Initially 1,049 patients were admitted for analysis. Thirty-three patients were excluded from the study for the following reasons: 6 patients were excluded because of

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See page 977 for disclosure information.

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Table 1
Baseline clinical and angiographic characteristics of the study population

Variable	Syntax Score		p Value
	≤22 (n = 678)	≥23 (n = 338)	
Age (years)	59 ± 12	66 ± 13	<0.001
Women	166 (24.5%)	120 (35.5%)	<0.001
Body mass index (kg/m^2)	28.3 ± 4.7	27 ± 4.1	<0.001
Hypertension	271 (40%)	155 (45.9%)	0.079
Diabetes mellitus	195 (28.8%)	136 (40.2%)	<0.001
Current smoker	344 (50.7%)	106 (31.4%)	<0.001
Hypercholesterolemia	257 (37.9%)	122 (36.1%)	0.302
Family history of coronary artery disease	176 (26%)	76 (22.5%)	0.248
Previous myocardial infarction	40 (5.9%)	28 (8.3%)	0.136
Previous stroke	11 (1.6%)	9 (2.7%)	0.337
ACS diagnosis			0.067
ST-segment elevation	432 (63.7%)	194 (57.4%)	
Non-ST-segment elevation	246 (36.3%)	144 (42.6%)	
Left ventricular ejection fraction (%)	50 ± 9	41 ± 11	<0.001
Prior medications			
Aspirin	94 (13.9%)	46 (13.7%)	0.560
Clopidogrel	32 (4.7%)	18 (5.3%)	0.185
Beta blocker	90 (13.3%)	49 (14.7%)	0.445
Renin angiotensin aldosterone antagonists	150 (22.2%)	57 (17.0%)	0.196
Statin	75 (11.1%)	44 (13.2%)	0.220
Implicated coronary artery			<0.001
Left anterior descending	269 (39.7%)	200 (59.2%)	
Left circumflex	163 (24%)	53 (15.7%)	
Right	243 (35.8%)	77 (22.8%)	
Left main coronary	3 (0.4%)	8 (2.4%)	
Multi-vessel disease	307 (45.3%)	296 (87.6%)	<0.001
Chronic total occlusion	74 (10.9%)	166 (49.1%)	<0.001
Stent implantation	598 (88.2%)	205 (60.7%)	<0.001
Patients underwent coronary bypass	28 (4.1%)	102 (30.2%)	<0.001
In-hospital mortality	13 (1.9%)	42 (12.4%)	<0.001

Table 2
Biochemical and hematological measurements of the study population

Variable	Syntax Score		p Value
	≤22 (n = 678)	≥23 (n = 338)	
White blood cell count (×10^9/L)	10.7 ± 3.4	11.3 ± 3.8	0.015
Platelet count (×10^9/L)	231 ± 61	248 ± 69	<0.001
Lymphocyte count (×10^9/L)	2.58 ± 1.19	1.66 ± 0.76	<0.001
Platelet-to-lymphocyte ratio	104 ± 43	172 ± 93	<0.001
Hemoglobin (g/dL)	14.3 ± 1.6	13.4 ± 2	<0.001
Glucose (mg/dL)	138 ± 74	167 ± 83	<0.001
Creatinine (mg/dL)	1.08 ± 0.28	1.15 ± 0.33	<0.001
Peak creatine kinase (U/L)	461 (196−1116)	611 (251−1554)	0.005
Peak creatine kinase-myocardial band (U/L)	36 (11−101)	47 (12−137)	<0.001
Peak troponin-T (ng/mL)	620 (160−1750)	1314 (336−4132)	<0.001
Total cholesterol (mg/dL)	196 ± 47	190 ± 50	0.079
High density lipoprotein cholesterol (mg/dL)	40 ± 9	41 ± 10	0.890
Low density lipoprotein cholesterol (mg/dL)	124 ± 40	120 ± 42	0.128
Triglyceride (mg/dL)	146 (96−200)	129 (91−194)	0.058
Uric acid (mg/dL)	5.61 ± 1.55	5.93 ± 1.86	0.004
High sensitivity C-reactive protein (mg/dL)	6.43 ± 4.18	7.79 ± 3.74	<0.001

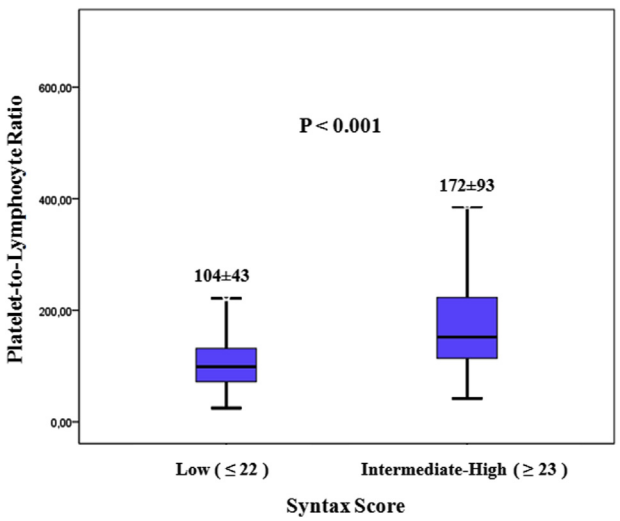

Figure 1. Comparison of PLRs between groups.

unavailability of laboratory data, 2 patients had histories of malignancy, 18 patients had histories of coronary artery bypass grafting, 5 patients had severe renal failure, and 2 patients had acute or chronic infection or inflammation. Therefore, a total of 1,016 patients were included in the study.

Exclusion criteria consisted of hematologic disorders, active infectious or inflammatory diseases, rheumatologic diseases, severe renal or liver disease, and malignancy. Because the SXscore has been used only for patients with native coronary artery lesions, patients with histories of coronary artery bypass grafting were also excluded.

STEACS was diagnosed when patients had symptoms of acute myocardial infarction lasting ≥30 minutes and accompanied by >1-mm (0.1-mV) ST-segment elevation in ≥2 contiguous leads and later confirmed by creatine kinase (CK) and CK-MB increases and/or troponin increase. NSTEACS was diagnosed when characteristic chest pain lasted ≥20 minutes with or without associated ST-segment depression ≥0.1 mV and/or T-wave inversion in 2 contiguous leads on the electrocardiogram or no electrocardiographic abnormalities and presence or absence of increased levels of troponin. Hypercholesterolemia was defined as total serum cholesterol >200 mg/dl or the use of lipid-lowering medication.

All patients were assessed with transthoracic echocardiography (Vivid 3; GE Vingmed Ultrasound AS, Horten, Norway) within 48 hours after admission at the hospital. The left ventricular ejection fraction (LVEF) was calculated using Simpson's method.