Research Article

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The Prognostic Value of Platelet–lymphocyte Ratio (PLR) in Patients with Non ST Segment Elevation Myocardial Infarction (NSTEMI)

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ABSTRACT

Background: *Inflammation characterizes atherothrombosis and the presence of inflammation at the site of the atherosclerotic lesion has a role in plaque formation and acute rupture. Previous studies demonstrated that elevated peripheral blood platelet count and a low peripheral blood lymphocyte count are associated with major adverse cardiovascular outcomes. Therefor we supposed that; platelet-lymphocyte ratio (PLR) may have a prognostic value in patients with NSTSEMI.*

Patents and Methods: *90 patients with NSTEMI were included in our study. Then Complete history was taken, General and local examination were done, Blood sample was taken for laboratory tests with especial interest to PLR, ECG, and bedside screening ECHO were done on admission. Lastly, Coronary angiography; SYNTAX (SX) score, TIMI flow and myocardial blush grade (MBG) were estimated.*

Results: *After classified our study population (90 patients) into three groups: Group 1 (N = 55): EF > 50%.*
Group 2 (N = 16): EF 40-50%.
Group 3 (N = 19): EF < 40%.
There was highly statistically significant difference between three groups regarding platelets, lymphocytes and PLR (P<0.001). PLR >149.05 had statistically highly significant positive correlation with SX score and troponin (p<0.001), on the other hand PLR had statistically highly significant negative correlation with EF and MBG (p<0.001) and had statistically significant negative correlation with TIMI flow (p<0.05).

Conclusion: *PLR >149.05 was associated with LV systolic dysfunction with sensitivity and specificity 100% and 84.5%, respectively.*

Keywords

NSTEMI, Platelet-lymphocyte ratio, Syntax score.

Introduction

Inflammation characterizes all phases of atherothrombosis and the presence of inflammation at the site of the atherosclerotic lesion has a role in both plaque formation and its acute rupture [1].

Previous studies demonstrated that elevated peripheral blood platelet count is associated with major adverse cardiovascular outcomes [2]. On the contrary, a low peripheral blood lymphocyte count is related with major adverse cardiovascular outcomes [3]. Therefor we supposed that; platelet-lymphocyte ratio (PLR) may have a prognostic value in patients with NSTSEMI.

Aim of the work

In this study we aimed to assess the prognostic value of PLR ratio in patients with NSTEMI.

Patients and Methods

This prospective study included 90 patients with NSTEMI who were admitted to the coronary care unit (CCU) of cardiology department at Zagazig University during the period from December 2016 to December 2017.

All patients signed an informed consent and the study was approved by local ethics committee.

Inclusion criteria

All our patients were admitted to coronary care unit with NSTEMI within 24 hours from onset of typical chest pain with dynamic ECG changes indicating myocardial ischemia with raised Troponin.

Exclusion criteria

1. Clinical evidence of cancer.
2. Active infection.
3. Hematological proliferative diseases.
4. Renal impairment.
5. Recent blood transfusion.
6. Severe hepatic diseases.
7. Previous MI.
8. Active or chronic inflammatory or autoimmune diseases.

Methods

A- Medical history.
B- General and local cardiac examination.
C- Standard 12 leads surface ECG.
D- Routine laboratory investigations: with especial interest to:
1. Complete blood count (CBC) and PLR is calculated as platelet count in (10^3/cmm)/ lymphocyte count in (10^3/cmm).
2. Cardiac Troponin.
3. Kidney function tests (S. Creatinine).
4. Lipid profile (cholesterol and triglycerides).
5. Random blood sugar measured on admission.

E- Echocardiography: The following parameters were determined: end diastolic volume (EDV), end systolic volume (ESV), and ejection fraction was calculated using modified Simpson's rule. In all cases, end systolic and end diastolic volumes were measured in the same cardiac cycle. Echocardiography was done to our patients before cardiac catheterization.
F- Coronary angiography and PCI: SYNTAX score (SX score), TIMI flow grade and myocardial blush grade were estimated.

We classified our study population (90 patients) according to EF into three groups: Group 1 (N = 55): EF > 50%, Group 2 (N = 16): EF 40-50% and Group 3 (N = 19): EF < 40%.

Table 1 showing: Statistically highly significant difference between three groups regarding platelet number (P<0.001). On applying post hoc test there was significant difference between group 1 vs group 2: p<0.001, group 1 vs group 3: p<0.001.

Statistically highly significant difference between three groups regarding lymphocyte count (P<0.001). On applying post hoc test there was significant difference between group 1 vs group 2: p<0.001, group 1 vs group 3: p<0.001. Statistically highly significant difference between three groups regarding PLR among studied groups (P<0.001). On applying post hoc test there was significant difference between group 1 vs group 2: p<0.001 and group 1 vs group 3: p<0.001.

Table 2 showing: Platelet count had statistically significant positive correlation with troponin (p<0.05) and had statistically highly significant positive correlation with SX score (p<0.001), on the other hand platelet count had statistically highly significant negative correlation with EF and MBG (p<0.001) and had statistically significant negative correlation with TIMI flow (p<0.05). Lymphocyte count had statistically highly significant positive correlation with EF and MBG (p<0.001), on the other hand lymphocyte count had highly statistically significant negative correlation with SX score and troponin (p<0.001). PLR had statistically highly significant positive correlation with SX score and troponin (p<0.001), on the other hand PLR had statistically highly significant negative correlation with EF and MBG (p<0.001) and had statistically significant negative correlation with TIMI flow (p<0.05).

Table 3 showing: statistically significant negative correlation between PLR and myocardial blush (p<0.05). Statistically significant positive correlation between lymphocyte and troponin level (p<0.05).

Table 4 showing: Statistically significant negative correlation between PLR and myocardial blush (p<0.05).

Table 5 showing: No significant correlation.

Figure 1: ROC curve was plotted to identify the optimal cutoff value for PLR to identify patients with NSTEMI who develop LVSD. The cutoff point was 149.05 with sensitivity and specificity 100% and 84.5%, respectively.

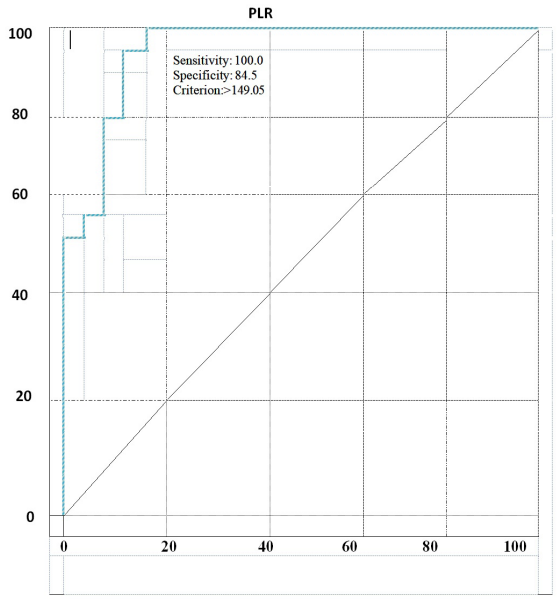

Figure 1: ROC curve.

Area under the ROC curve (AUC)	0.958
Standard Error	0.0185
95% Confidence interval	0.893 to 0.989
z statistic	24.783
Significance level P (Area=0.5)	<0.0001

	Group 1 (N=55)	Group 2 (N=16)	Group 3 (N=19)	F	P-Value	Post-hoc test
Plt (x10^3/cmm)	244.1 ± 41.4	296.8 ± 55.5	304.3 ± 42.8	17.6	<0.001	Group 1 vs Group 2: p<0.001 Group 1 vs Group 3: p<0.001
Lymphocytes (x10^3/cmm)	2.7 ± 0.5	2 ± 0.3	1.7 ± 0.3	44.1	<0.001	Group 1 vs Group 2: p<0.001 Group 1 vs Group 3: p<0.001
PLR	92.9 ± 18.9	148.1 ± 26.2	177.9 ± 28	116.2	<0.001	Group 1 vs Group 2: p<0.001 Group 1 vs Group 3: p<0.001

Table 1: Comparison between 3 groups regarding Plt, lymphocyte and PLR. Plt: platelet, PLR: platelet lymphocyte ratio.

		Plt	Lymphocyte	PLR
EF	R	-0.6	0.6	-0.8
	P	< 0.001	< 0.001	< 0.001
TIMI flow	R	-0.3	0.2	-0.3
	P	0.004	0.059	0.004
SYNTAX score	R	0.4	-0.4	0.6
	P	< 0.001	<0.001	< 0.001
MBG	R	-0.5	0.6	-0.7
	P	< 0.001	< 0.001	< 0.001
Troponin	R	0.3	-0.5	0.6
	P	0.004	< 0.001	< 0.001

Table 2: Correlation between Plt, Lymphocyte and PLR findings and angiographic scores, troponin and EF in the study population.
MBG: Myocardial blush grade, Plt: platelet, PLR: platelet lymphocyte ratio, EF: ejection fraction.

		Plt	Lymphocyte	PLR
Troponin	R	-0.1	0.4	0.1
	P	0.468	0.002	0.468
TIMI flow	R	-0.2	0.0	-0.2
	P	0.143	1	0.143
MBG	R	-0.1	0.2	-0.3
	P	0.468	0.143	0.026
SYNTAX score	R	0.1	0.1	0
	P	0.468	0.468	1

Table 3: Correlation between Plt., lymphocyte and PLR findings and angiographic scores and troponin in group 1.
MBG: Myocardial blush grade, Plt: platelet, PLR: platelet lymphocyte ratio, EF: ejection fraction.

		Plt	Lymphocyte	PLR
Troponin	R	0.2	0.1	0.0
	P	0.458	0.713	1
TIMI flow	R	-0.2	0.1	-0.2
	P	0.458	0.713	0.458
MBG	R	-0.3	0.2	-0.5
	P	0.259	0.458	0.049
SYNTAX score	R	0.2	-0.4	0.1
	P	0.458	0.125	0.713

Table 4: Correlation between Plt., lymphocyte and PLR findings and angiographic scores and troponin in group 2.
MBG: Myocardial blush grade, Plt: platelet, PLR: platelet lymphocyte ratio, EF: ejection fraction.

		Plt	Lymphocyte	PLR
Troponin	R	0.1	0.0	0.4
	P	0.684	1	0.09
TIMI flow	R	-0.4	0.2	-0.2
	P	0.09	0.412	0.412
MBG	R	-0.2	0.0	-0.2
	P	0.412	1	0.412
SYNTAX score	R	0.2	-0.1	0.1
	P	0.412	0.684	0.684

Table 5: Correlation between Plt, lymphocyte and PLR findings and angiographic scores and troponin in group 3. MBG: Myocardial blush grade.

Independent variables	Coefficient	P
Myocardial blush	-0.05892	0.2965
PLR>149.05	0.5750	<0.0001
Syntax score	-0.0005899	0.9102
TIMI flow	-0.01501	0.6757
TIMI risk score	-0.002037	0.9601

Table 6: Regression analysis to identify independent predictors of systolic dysfunction.

Discussion

PLR reflects both hyperactive coagulation and inflammatory pathways; it may be a better predictor of impaired perfusion than either the individual platelet or lymphocyte count [4]. Increased platelet and low lymphocyte counts has poor cardiovascular outcomes [5]. In this regard, our study showed that; there was significant difference between the three groups regarding platelet count, lymphocyte count and PLR as, platelet count, platelet lymphocyte ratio were increased in group 3 while lymphocyte count was decreased. In addition, there was highly significant negative correlation between TIMI flow, MBG and EF with platelet count and PLR while there was highly significant positive correlation with SX score. Kurtul et al., [6] in 2017 stated that PLR is an independent predictor of the prevalence of more complex coronary artery lesions (SX score> 23) in patients with ACS. The mechanisms of the relation between PLR and SX score are not clear. One of the possible mechanisms may be an increased inflammatory response. Higher platelet counts may reflect underlying inflammation, as several inflammatory mediators stimulate megakaryocytic proliferation and produce relative thrombocytosis. On the other side, lymphocytes represent a quiescent and controlling inflammatory pathway Yildiz et al., [7] in 2015 found that high pre-procedural PLR levels were significant and independent predictors of no reflow in patients undergoing PCI. Independent predictors of systolic dysfunction were determined by regression analysis. PLR > 149.05 was found to be associated with systolic dysfunction. This is in accordance with the findings of Bekler et al., [8] in 2015 as they found that, PLR > 135.6 was found to be associated with systolic dysfunction in patients with non-ST elevated ACS. The underlying mechanisms of the association between higher PLR and worse prognosis seem to be multifactorial. Firstly, higher platelet counts serve to be both a result and a precipitating factor of inflammatory response. It is reported that megakaryocyte could be stimulated by several inflammatory mediators and presented accelerated proliferation and platelet-production. Burstein et al., [9] in 1992 has been proposed that in response to physiologic stress during myocardial ischemia or infarction, there is release of cortisol and catecholamine, redistribution of lymphocytes to lymphatic organs, and apoptosis, which lead to lymphopenia. High level of physiologic stress mean high levels of cortisol and catecholamine, which can translated into a lower lymphocyte count.

In our multivariate regression analysis, we found that PLR is an independent significant predictor of LVSD. Eventually, both thrombocytosis and lymphopenia correlate with the degree of systemic inflammation, and PLR indicates a new marker incorporating both hematologic indices. These possible mechanisms can explain why a higher PLR is independently related with LVSD. The increased inflammatory response appears to be mediated by greater myocardial damage in NSTEMI patients. Therefore, in this study, we have proposed that the inflammatory process, although not directly, but is strongly associated with adverse cardiovascular outcome.

Conclusion

- PLR is simple and inexpensive methods for evaluating patients with NSTEMI.
- PLR has been investigated as a simple a feasible new prognostic inflammatory marker for adverse cardiovascular outcomes in many types of cardiovascular diseases. A high PLR is a strong and independent predictor for LVSD in patients with NSTEMI. PLR and clinical findings are helpful to determine high-risk patients and treatment strategies.
- In our study, regression analysis showed that PLR >149.05 was associated with LV systolic dysfunction with sensitivity and specificity 100% and 84.5%, respectively.
- In our study PLR has highly significant correlation with SX score, TIMI flow, MBG, and EF which has been approved to have a prognostic value.

Study limitations

A small number of patients were included.
The study was performed in a single center.
No follow up.

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