FULL LENGTH ARTICLE

The platelet-to-lymphocyte ratio as a predictor of all-cause mortality in patients with coronary artery disease undergoing elective percutaneous coronary intervention and stent implantation

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Background: **There is no data regarding the association between the platelet-to-lymphocyte ratio (PLR) and long-term mortality in patients with stable coronary artery disease (SCAD). The aim of this study is to evaluate the utility of the pre-procedural PLR for predicting long-term, all-cause mortality in patients with SCAD undergoing percutaneous coronary intervention (PCI) and stent implantation.**

Methods: **We analyzed a total of 2959 consecutive patients with SCAD who underwent PCI (balloon angioplasty followed by stent implantation or direct stenting) between July 2006 and December 2011 at our institution. The patients were stratified into tertiles according to their admission PLR. The association between the PLR value and the outcomes was assessed using Cox proportional regression analysis after adjusting for clinical angiographic and laboratory data.**

Results: **During median follow-up of 1124 days, mortality was highest in patients with PLR within the 3rd tertile as compared to the 2nd and the 1st tertile (11.0% vs 8.7% vs. 9.6%, respectively, $p = 0.03$). PLR remained associated with mortality in multivariable analysis including clinical variables, ejection fraction and angiographic parameters HR (per 10 units increase) = 1.02 [95% CI,1.01 ÷ 1.04, $p = 0.006$]. After adjustment for the eGFR and hemoglobin levels, PLR was however no longer significantly associated with mortality.**

Conclusion: **PLR has potential predictive value in patients with SCAD, which has not been reported previously, but statistical significance disappears after adjusting for estimated glomerular filtration rate (eGFR) and hemoglobin levels as a potential confounding variable.**

Keywords: Platelet-to-lymphocyte ratio, Percutaneous coronary intervention, Mortality

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Introduction

Numerous studies have shown the association between elevated platelet counts and cardiovascular mortality [1–3]. It has been also shown that the elevated level of neutrophils and relative lymphocytopenia are negative prognostic indexes of outcomes in patients with coronary artery disease and heart failure (HF) [4–9].

Platelet-to-lymphocyte ratio (PLR) which can be derived from the complete blood count is a novel index reflecting a systemic inflammatory burden that combines prognostic values of an individual's platelet and lymphocyte count [4,9]. In patients with non-ST-elevation myocardial infarction (NSTEMI) and ST elevation myocardial infarction (STEMI), the PLR ratio is an independent predictor of mortality [10,11].

Moreover, in patients with myocardial infarction (MI) treated by primary PCI, PLR is an independent risk factor for more advanced coronary artery disease as reflected by higher Syntax scores and no-reflow phenomenon [12]. Data regarding PLR and its association with long-term prognosis in stable coronary artery disease (SCAD) patients are, however, lacking. We hypothesized that PLR is a potential marker of prognostic importance in patients with SCAD. The aim of our study was to establish the impact of the baseline PLR ratio on all-cause, long-term mortality in patients after PCI and stent implantation.

Abbreviations

HF	heart failure
PLR	platelet/lymphocyte ratio
NSTEMI	non-ST-elevation myocardial infarction
STEMI	ST elevation myocardial infarction
MI	myocardial infarction
PCI	percutaneous coronary intervention
SCAD	stable coronary artery disease
CABG	coronary artery bypass grafting
COPD	chronic obstructive pulmonary disease
BMI	body mass index
EF	ejection fraction
Hb	hemoglobin
eGFR	estimated glomerular filtration rate
CKD-EPI	Chronic Kidney Disease Epidemiology Collaboration
CCS	Canadian Cardiovascular Society
NYHA	New York Heart Association

Methods

Data collection

For the purpose of this study, we examined a computer database to identify patients with SCAD referred to the Silesian Center for Heart Diseases in Poland who underwent coronary angiography and stent implantation between July 2006 and December 2011. In this database, information on coronary intervention, concomitant diseases, demographic data and laboratory parameters such as platelet and leukocyte counts are stored. The complete blood counts, which included total white blood cells, neutrophils, lymphocytes and platelets, were obtained using an automated blood counter Sysmex XS1000i and XE2100 (Sysmex Corporation, Kobe, Japan). Platelet-to-lymphocyte ratio was calculated as the ratio of the platelets to lymphocytes, obtained from the blood samples that were taken at the fasting state.

Patients undergoing hybrid revascularization, patients after orthotropic heart transplant, patients with known hematological diseases, patients on dialysis, or with other diseases limiting survival were excluded from the analysis. One patient died during the in-hospital period due to periprocedural complications. This patient was also excluded from this analysis.

The study was approved by the Local Ethics Committee at the District Chamber of Physicians.

Follow-up data

Information on survival was based on the National Health Fund insurance status, which can be electronically verified because the National Health Fund insurance policy is obligatory for all Polish citizens, and patients who were insured were marked as alive. We made an attempt to contact the relatives of uninsured patients and/or the relevant local registry office to obtain the date of death. Complete follow-up data (including eventual event and time of the event) were available for 2947 (99.6%) patients.

Statistical analysis

The normality of continuous variable distribution was tested with a Shapiro-Wilk test and deviation from the normal distribution was inspected by analysis of the normal probability plots (Quantile-Quantile plots). The continuous variables are not normally distributed, and are therefore presented as median and interquartile ranges. The dichotomous variables are presented as percentages. Patients were divided into subgroups according to PLR tertiles. Group I included patients with PLR < 87 (n = 986); group II included patients with PLR value of $\geqslant$87 and < 121 (n = 986); and group III included patients with PLR $\geqslant$ 121 (n = 987).