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PREDICTIVE VALUE OF NEUTROPHIL-TO-LYMPHOCYTE RATIO, PLATELET-TO-LYMPHOCYTE RATIO, AND SYSTEMIC IMMUNE-INFLAMMATION INDEX FOR NO-REFLOW PHENOMENON AFTER PRIMARY PERCUTANEOUS CORONARY INTERVENTION

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Abstract

Background

One of the major complications of ST-segment elevation myocardial infarction (STEMI) is no-reflow after first percutaneous coronary intervention (PCI). Using inflammatory indicators, its presence may be anticipated.

Objective

In order to evaluate NLR, PLR, and SII's capacity to foretell successful main PCI without reflow.

Place and Duration of Study

From April 2026 to August 2026 at the Department of Cardiology, University of Lahore Hospital.

Methodology

A prospective observational study of 150 STEMI patients received primary PCI was performed. Sample size was determined according to WHO formula. The blood count measurements taken before the procedure were used to compute NLR, PLR, and SII. Coronary flow was ascertained by TIMI grading.

Results

Of 150 patients, 32 (21.3%) developed no-reflow, while 118 (78.7%) achieved normal flow. The frequency of elevated NLR, PLR, and SII were 71.9%, 65.6%, and 78.1% for no-reflow patients, respectively. The strongest predictive association was for SII.

Conclusion

One possible application for NLR, PLR, and SII is to forecast the absence of reflow after initial PCI.

INTRODUCTION

Major cardiovascular emergencies called ST-segment elevation myocardial infarction (STEMI) occur when the coronary arteries become suddenly blocked, causing myocardial ischemia and potentially long-term damage to the heart. Therefore, restoring coronary blood flow as soon as possible is a primary goal of treatment (Wang et al., 2023). Primary PCI (PCI) is a well-established re perfusion approach for STEMI patients as it provides patenting of the IRC and thereby reduces myocardial injury. However, even with successful opening of the pericardial coronary artery, there is not always good myocardial tissue perfusion. This phenomenon, called "no-reflow", is a significant clinical issue post-primary PCI. No-reflow typically occurs when there is no significant residual mechanical obstruction even though the coronary and/or myocardial perfusion is reduced (Cakmak et al., 2024). Recent evidence has suggested that no-reflow is linked with adverse outcomes and is clinically important, for which early recognition is essential and preventing the phenomenon is crucial.

No-reflow has multiple mechanisms and is multi factorial. Impaired myocardial perfusion may be caused by distal micro embolization, endothelial dysfunction, ischemia-re perfusion injury, micro vascular obstruction, platelet activation, leukocyte accumulation, oxidative stress and inflammatory responses (Karadeniz et al., 2024). It is especially important to note the particular importance of inflammation, in which the acute myocardial infarction causes significant alteration in inflammatory cells and platelets in the circulation (Memon et al., 2026). As a result, routine complete blood counts (CBCs) have been gaining in interest as inexpensive and readily available tools for risk assessment and thus biomarkers of these blood counts have come into focus.

Eutrophic-to-Lymphocyte Ratio (NLR) is a combination of changes in neutrophils and lymphocytes and gives an index of the systemic inflammatory activity (Yang et al., 2024). The platelet-to-lymphocyte ratio (PLR) is another metric that integrates platelet function with immunological and inflammatory responses. A thorough measure of the interplay between inflammation, immunity, and systemic inflammation is the systemic immune-inflammation index (SII) thrombosis, based on the combination of platelet, neutrophil and lymphocyte counts (Liu et al., 2026). These indices have been especially appealing in the setting of acute cardiac care, as they do not require expensive, specialized, or extensive testing.These indices have proven particularly appealing in the setting of acute cardiac care because they can be calculated from routine laboratory tests without the need for expensive, specialized, or extensive testing (Zahran et al., 2026). SII has also been studied as a prognostic factor about the absence of reflow and unfavourable outcomes in patients following initial PCI for STEMI.

Increased inflammatory indices have been shown to have significant relationships with impaired coronary reperfusion in previous studies (H. Yu et al., 2025). In this study of 785 patients with STEMI, NLR, PLR and SII individuals with normal coronary flow had much lower levels than those who had no-reflow. Significantly, compared to NLR and PLR, SII had a larger area under the receiver operating characteristic curve, suggesting that it may have superior discriminating capabilities (Karasu et al., 2024). Patients without reflow had much higher SII, and this in turn was shown to be a reliable indicator of reduced myocardial perfusion in a separate study.

However, despite these results, no-reflow is still difficult to predict as there are multiple patient-related, inflammatory, angiographic and procedural factors that could affect no-reflow (Liu et al., 2023). A recent systematic review highlighted the ongoing significance of the predictive approach due to the lack of definitive treatment and prevention is key to the clinical management of no-reflow (AYDIN & DEMİRKIRAN, 2025). Thus, if it is possible to

identify reliable biomarkers prior to primary PCI, then it will be possible to stratify patients at risk for an early event and begin to monitor them more closely. The current study is to identify and compare the predictive value of NLR, PReducing LR and SII to prevent reflow in STEMI patients undergoing initial percutaneous coronary intervention (Zhang et al., 2025). These easily accessible inflammatory markers could represent a simple and cost-effective methodto determine whether individuals are most likely to have problems during reperfusion and aid in the clinical decision making process.

Objective

In order to determine if NLR, PLR, and SII are useful predictors of no-reflow in STEMI patients who have primary PCI.

Methodology

This prospective observational study was carried out at the Department of Cardiology, University of Lahore Hospital, from April 2026 to August 2026. We included 150 patients who had primary percutaneous coronary intervention (PCI) after suffering an ST-segment elevation myocardial infarction. The World Health Organization's (WHO) sample size calculation was used to ascertain the sample size. After obtaining informed permission, patients who met the pre-established eligibility criteria were enrolled in the study. We gathered demographic, clinical, and angiographic information. Prior to the surgery, a full blood count was taken, which included tests for systemic immune-inflammation index, platelet-to-lymphocyte ratio, and neutrophil-to-lymphocyte ratio. After percutaneous coronary intervention (PCI), the TIMI flow grade was used to evaluate coronary reperfusion. Patient groups were then classified as either normal-flow or no-reflow. The relationships between inflammatory indicators and no reflow were determined using appropriate descriptive and inferential statistical approaches.

Inclusion Criteria

Patients undergoing primary percutaneous coronary intervention who were at least 18 years old and had an ST-segment elevation myocardial infarction were included in the study. All male and female patients who made an appearance within the specified time limits, having prior complete blood counts and complete angiographic records were deemed eligible for participation.

Exclusion Criteria

Patients, who were infected, presented with tumor disease or hematological disorders, chronic inflammatory and autoimmune disease, severe hepatic or renal dysfunction, or recent major surgery were excluded. Patients who were being treated with immunosuppression drugs and those with incomplete laboratory data or previous thrombolytic treatyment or inadequate oceanographic data were also not included in the study.

Data Collection

A data collection form was used for the data collection, and informed consent was obtained from eligible participants. Demographic data, including sex and age, and clinical data (diabetes mellitus, hypertension, smoking, previous cardiovascular history) was obtained. Venous blood samples were taken for complete blood counts prior to primary PCI. These absolute neutrophils, absolute lymphocytes, and absolute platelets counts were recorded and NLR, PLR and SII were calculated. Primary PCI angiographic and procedural data such as infarct related artery and post-procedural coronary flow were documented. TIMI flow grading system was used to evaluate coronary reperfusion. No reflow patients were defined based on the study criteria as patients with impaired post PCI flow. All the data gathered was checked for completeness and entered into a database, which was then analysed statistically.

Results

The sample size was 150 patients with STEMI who had percutaneous coronary intervention (PCI). Only 32 (21.3%) showed signs of reflow, whereas 118 (78.7%) showed signs of normal coronary flow. In 25 patients (78.1%) who did not experience reflow, high SII was detected, raised PLR in 21 patients (65.6%), and elevated NLR in 23 patients (71.9%). In general, patients without reflow had higher levels of inflammatory markers compared to those with normal reflow. Of the markers that were considered for no-reflow prediction, SII outperformed NLR and PLR. This study's findings provide support for the idea that patients with STEMI who had greater pre-procedure inflammatory indices would be better categorised as having a higher probability of no-reflow after first PCI.

Table 1. Baseline Characteristics of Study Participant

Characteristic	No-Reflow (n=32)	Normal Flow (n=118)	Total (n=150)
Mean age, years	61.4 ± 9.2	56.8 ± 10.1	57.8 ± 10.0
Male	23 (71.9%)	82 (69.5%)	105 (70.0%)
Hypertension	21 (65.6%)	58 (49.2%)	79 (52.7%)
Diabetes mellitus	17 (53.1%)	42 (35.6%)	59 (39.3%)
Current smokers	15 (46.9%)	45 (38.1%)	60 (40.0%)

Table 1 provides the study population's baseline data. The prevalence of hypertension and diabetes mellitus was highest among the elderly individuals compared with patients with normal coronary flow that developed no-reflow. There was a higher prevalence of male gender and smoking in both groups, and a higher male gender to male smoking ratio in the no-reflow group.Male predominance, smoking were comparatively more common in both groups with a higher ratio of male gender to male smoking in the no-reflow group.

Table 2. Frequency of Post-PCI Coronary Flow Outcomes

Coronary Flow Outcome	Frequency (n)	Percentage
No-reflow	32	21.3%
Normal flow	118	78.7%
Total	150	100.0%

The frequency of the coronary flow outcomes after primary PCI are summarized in Table 2. Thirty-two patients (21.3% of all patients) were found to have no-reflow. However, 118 patients (78.7%) had normal coronary flow. Therefore, around 20% of patients had suboptimal reperfusion following primary PCI.

Table 3. Comparison of Inflammatory Indices

Parameter	No-Reflow (n=32)	Normal Flow (n=118)	p-value
NLR	6.8 ± 2.4	4.1 ± 1.7	<0.001
PLR	184.6 ± 52.3	137.8 ± 43.5	<0.001
SII	1325 ± 486	795 ± 341	<0.001

those without reflow had much higher mean values for NLR, PLR, and SII than those with normal coronary flow (Table 3). A correlation between elevated systemic inflammation and no-reflow was suggested by the fact that all three inflammatory parameters showed significant group differences ($p<0.001$).

Table 4. Elevated Inflammatory Markers Among No-Reflow Patients

Inflammatory Marker	Elevated, n	Percentage
NLR	23	71.9%
PLR	21	65.6%
SII	25	78.1%

The distribution of elevated inflammatory markers in the 32 patients who developed no-reflow is shown in Table 4. Elevated SII (78.1%) was the most common abnormality, followed by an elevated NLR (71.9%) and an elevated PLR (65.6%). The results indicate that SII may be more effective in identifying the high risk patients.

Table 5. Predictive Performance of Inflammatory Indices

Marker	AUC	Sensitivity	Specificity	p-value
NLR	0.78	71.9%	72.0%	<0.001
PLR	0.73	65.6%	69.5%	<0.001
SII	0.84	78.1%	76.3%	<0.001

The predictive ability of the three inflammatory indices is compared in table 5. The AUC (0.84), sensitivity (78.1%) and specificity (76.3%) of SII were higher than those of NLR and PLR, suggesting that SII had better discriminatory power. The NLR was moderately predictive while PLR had a lower value for AUC, sensitivity, and specificity, when compared with other markers.

DISCUSSION

In this study, researchers looked at patients with ST-segment elevation myocardial infarction (STEMI) and assessed the predictive power of eutrophic-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), and systemic immune-inflammation index (SII) for no-reflow after primary percutaneous coronary intervention (PCI) (Ma et al., 2022). The results showed that 21.3% of patients had no-reflow and 78.7% had normal coronary flow. Patients without normal flow had significantly higher inflammatory indices than patients with normal flow, suggesting that systemic inflammation plays a key role in myocardial re perfusion following primary PCI (Kaplangoray et al., 2024).

No-reflow is a multi-factorial effect that encompasses: micro vascular obstruction, endothelial dysfunction, distal embolization, platelet activation, ischaemia-re perfusion injury and inflammatory response (Tunca et al., 2026). Primary PCI may be effective to re-open pericardial coronary arteries, but some patients may have inadequate micro vascular perfusion. Inflammatory cells can further injure the endothelial cells, plug the micro vascular, and release inflammatory mediators that can further affect myocardial blood flow. Thus, pre-pay inflammatory markers may be useful to assess the risk of postpaid no-reflow (Xie et al., 2025).

In this study, 71.9% of the patients who developed no-reflow exhibited elevated NLR. NLR is a balance between the eutrophic-mediated inflammatory activity and the immune-regulatory effect of lymphocytes (Wang et al., 2024).

Necrophilia could be a sign of an enhancement in the acute inflammatory response, and nymphomaniac could be a sign of physiological stress. Therefore, a high NLR can predict a patient who has a more inflammatory disease and be more prone to develop coronary micro vascular dysfunction. Association observed proves the possible clinical utility of NLR as an inexpensive early risk assessment parameter (J. Yu et al., 2025).

PLR was significantly raised in 65.6% of patients that developed no-reflow. Platelets play a key role in thrombosis and could be involved in distal microelectronics and microvascular obstruction in primary PCI (Bian et al., 2023). A raised PLR can thus be due to increased platelet activity and generalised inflammation. PLR, however, had relatively poor predictive ability when compared to NLR and SII in this study. This discovery indicates that PLR may have clinical value, though it might not be as discriminatory when used as a standalone test (Xu et al., 2025).

The highest association with no reflow was observed with SII, with an increase in 78.1% of the affected patients. It also had the highest predictive performance of the three markers explored. This could be attributed to the simultaneous inclusion of neutrophil, platelet and lymphocyte counts in SII, which give a more complete picture of inflammatory, thrombotic and immune processes (Shi et al., 2023). This may be related to its combined nature, making it better able to differentiate patients at risk for inadequate coronary reperfusion.

The clinical implications are that these findings are easily computed from routine laboratory complete blood count (CBC) performed prior to primary PCI and can have a clinical importance (Shen et al., 2022). They do not need any further special investigations and can be used as potential practical and cost effective risk stratifiers at an early stage. Strategies to identify the patients with the high levels of inflammatory indices could lead to more intensive procedural and post-procedural surveillance. Results indicate that all three indices could be used for no-reflow prediction, but SII seems to have a higher prediction potential (Rostamzadeh et al., 2024).

CONCLUSION

The study suggests that NLR, PLR and SII could serve as promising inflammatory markersin order to anticipate patients who will not have reflow after initial percutaneous coronary intervention (PCI) for ST-elevation myocardial infarction (STEMI), individuals with elevated inflammatory indices compared to those with normal coronary flow. The markers analyzed demonstrated the best predictive capabilities, with SII being the best followed by NLR and PLR. These indices can be readily obtained from routine complete blood counts, without special tests. The use may help in early detection and risk stratification of patients at risk for myocardial reperfusion impairment. They should be further evaluated by large-scale studies to validate their predictive value and to set up suitable clinical cut-off values.

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