Mean platelet volume as a biomarker of the risk and prognosis of coronary artery disease

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Mean platelet volume has been reported as potential tool in predicting patients who may develop coronary artery disease after primary percutaneous intervention.[1] Clinical assessment of MPV is ongoing. Currently, three lines of evidence suggest that it is potentially a clinically useful biomarker for risk stratification of patients who may develop coronary artery disease after PCI. First, several studies have addressed the frequencies of impaired reperfusion, left ventricular systolic dysfunction, and mortality in patients with acute myocardial infarction (AMI) who have undergone primary PCI or thrombolysis.[2,3] Second, some studies have shown that MPV is a useful predictive marker of short- and long-term clinical outcomes in unselected PCI cohorts, regardless of whether the patients had undergone elective or primary PCI.[4] Third, some reports have suggested that MPV, or changes in it over time, reflect high residual platelet reactivity after conventional dual antiplatelet therapy in patients who have undergone PCI.[5]

Mean platelet volume as a biomarker for acute myocardial infarction

Acute myocardial infarction occurs due to coronary atherosclerosis as well as thrombosis.[1]When atherosclerotic plaque ruptures or erode, platelets are recruited to the exposed subendothelial region and the partially occluded vessels become completely occluded with the new formed thrombus. Large platelets have greater thrombotic potential and are biologically more potent.[6] Increased platelet volume has been shown to be more reactive with greater production of thromboxane A2 and serotonin. Studies have reported platelet volume to be significantly higher among acute myocardial infarction patients than control subjects.[7,8]

An elevated MPV correlates with poor clinical outcomes among survivors of myocardial infarction in the era of thrombolysis and an impaired response to thrombolysis in those with ST segment elevated myocardial infarction.[9] MPV is also a strong independent predictor of impaired angiographic reperfusion, in-hospital major adverse cardiovascular events, and 30-day, 6-month, 12-month, and 2-year mortality from STEMI treated via primary PCI.[10,11,12] In addition, a higher MPV on admission is independently associated with impaired microvascular perfusion, a poor post-intervention myocardial blush grade, decreased post-PCI thrombolysis, and a poorer myocardial infarction flow grade (thrombolysis in myocardial infarction [TIMI]) in STEMI patients treated via primary PCI.[12,13,14]

In one study, a higher MPV on admission was strongly associated with greater microvascular resistance, a steeper diastolic deceleration time, a lower thermodilution-derived coronary flow reserve, and a higher coronary wedge pressure.[14]MPV seems to play a role in mediating reperfusion injury. In patients with STEMI scheduled for PCI, MPV at admission may be a valuable discriminator of a higher-risk patient subgroup, and a useful guide when deciding whether adjunctive therapy may be necessary to improve outcomes.[15]

Mean platelet volume as prognostic tool in percutaneous coronary intervention outcome

MPV has been reported as a useful biomarker in early identification of patients with stable coronary artery disease at high risk of post-PCI low-reflow. Studies have shown that pre-procedural elevated MPV is associated with the incidence of major adverse cardiac event and restenosis following PCI.[16] The study submitted that MPV is a potential marker of restenosis after PCI. Another study reported that MPV independently predicted post-PCI-corrected thrombolysis in myocardial infarction frame count.[17]Similar to the effects of MPV on AMI, several studies have found that an elevated MPV is a strong independent predictor of long-term outcomes after PCI.[4,18] However, one study found that mortality increased when the MPV rose over time after PCI, but the pre-procedural MPV was not predictive in this context.[19] It was suggested that monitoring MPV after PCI might aid in risk classification.

Mean platelet volume and residual platelet interference in dual antiplatelet therapy

Antiplatelet therapy reduces the incidence of both procedure-related complications and ischemic cardiovascular events after PCI.[20]Particularly, dual antiplatelet therapy (aspirin and an ADP receptor inhibitor) is the present standard of care after implantation of drug-eluting stents. Nevertheless, high residual platelet reactivity can limit the utility of antiplatelet therapy, increasing the frequency of cardiovascular events both during the procedure and during long-term follow-up.[21,22]

However, Paulu et al.,[23] in a prospective observational study, showed that clopidogrel resistance was not of prognostic utility in an unselected cohort of 378 patients who underwent PCI. In addition, Collet et al.,[24] observed no significant improvement in clinical outcomes when platelet function was monitored and adjusted in patients who underwent coronary stenting, compared to those who received standard antiplatelet therapy (without monitoring); this was a large, randomized open-label study on 2,440 patients.

Platelet activity testing can be time-consuming, expensive, and technically complex.[25] However, MPV can be readily measured before PCI using automated hematology analyzers. Recently, Kim et al.,[26]suggested that a high MPV was associated with reduced responses to aspirin and clopidogrel. Some investigators have suggested that an increase in MPV over time after PCI is associated with high on-treatment platelet reactivity.[5]Moreover, Choi et al.[4] suggested that MPV was superior to platelet function testing in terms of predicting cardiac death or cardiovascular events in patients who had undergone PCI, particularly those in an acute coronary syndrome subgroup.

Limitations

MPV can be simply and inexpensively determined and does not require professional interpretation. However, there are several limitations to using MPV as an indicator of heart disease. This is because most relevant studies have been retrospective in nature, enrolled small numbers of patients, or had confounding factors that may have affected platelet volume.[27]Furthermore, a wide range of cut-off values has been used in retro-spective studies, emphasizing that prospective works are needed.

Conclusions

Many studies have shown associations between an elevated MPV and poor clinical outcomes after PCI in patients with coronary artery disease. The marker also affords valuable insights into how to identify patients at high risk for coronary artery disease after PCI, and provides useful guidance as to when additional adjunctive therapy

is needed to improve clinical outcomes.

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