

Platelet volume indices correlate to severity of heart failure and have prognostic value for both cardiac and thrombotic events in patients with congenital heart disease

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Introduction: Patients with heart failure are reported to have activated platelets leading to thrombotic events. Consequently, immature giant platelets are produced, and platelet distribution width (PDW) and mean platelet volume (MPV) increase. These platelet indices are easily, reasonably, and safely available by routine blood test and recently have been proposed as potential markers of cardiac events. However, little is known about the usefulness of platelet indices in patients with congenital heart disease (CHD).

Purpose: To test whether the hypothesis that PDW and MPV correlate to the severity of heart failure and have prognostic value in both future heart failure-related admission and thrombosis formation in patients with CHD.

Methods: We performed a retrospective, single-centre study that included 400 patients with CHD (median age, 34 years [range: 12–76]; 49% males; 35% single ventricular morphology), who were admitted in our institute between April 2014 and June 2017. We reviewed patients' medical records to assess their clinical information including medical history, blood sample data, and echocardiologic parameters. At first, we assessed the correlation between platelet indices and patients' clinical parameters. Next, we compared platelet indices before and after treatment for heart failure. Finally, using logistic regression and Kaplan-Meier analyses, we assessed prognostic factors of future heart failure-related admission and thrombosis formation.

Results: In multivariate analysis, a significant correlation was found between PDW and logBNP (brain natriuretic peptide) ($p<0.001$), haemoglobin ($p=0.01$), D-dimer ($p=0.019$), Fontan operation ($p<0.001$) and male sex ($p<0.001$); as well as between MPV and logBNP ($p<0.001$), D-dimer ($p<0.001$) and Fontan operation ($p=0.002$). Throughout treatment of heart failure, significant reduction was found both in PDW (average value before treatment = 14.2, after treatment = 13.2, $p=0.002$) and MPV (before = 11.2, after = 10.8, $p=0.004$). In multivariate logistic regression analysis, predictors of future heart failure-related admissions were PDW (hazard ratio [HR]: 1.365; 95% confidence interval [CI]: 1.005–1.768), MPV (HR: 1.472; 95% CI: 1.055–2.052), age (HR: 1.063; 95% CI: 1.010–1.119), and SpO₂ under 85% (HR: 5.089; 95% CI: 1.350–19.18). Using the same analysis, predictors of thrombotic formation were PDW (HR: 1.998; 95% CI: 1.461–2.630), MPV (HR: 1.792; 95% CI: 1.155–2.781), logBNP (HR: 1.196, 95% CI: 1.085–1.320), D-dimer (HR: 1.024; 95% CI: 1.007–1.042) and male sex (HR: 3.071; 95% CI: 1.079–8.737). In addition, during median follow-up of 28 months, the Kaplan-Meier analysis showed an improvement in both heart failure and thrombosis-free survival in the low PDW, as well as the low MPV group.

Conclusion: Platelet volume indices correlate to severity of heart failure and have prognostic value for both cardiac and thrombotic events in patients with congenital heart disease.

