Residual Microvasculature Dysfunction (RMVD) after percutaneous coronary intervention (PCI) assessed by stress-transthoracic Doppler echocardiography (S-TDE)

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Background: Microvascular dysfunction (MVD) has been increasingly acknowledged as a relevant cause of myocardial ischemia and worse prognosis. Coronary flow velocity reserve (CFVR), an integrated marker of coronary circulation, can be obtained noninvasively by stress-TDE. However, limited data is available regarding residual MVD (RMVD) of the target territory after percutaneous coronary intervention (PCI) assessed by stress-transthoracic Doppler echocardiography (S-TDE).

Purpose: This study aimed to investigate the echocardiographic predictors for RMVD after PCI assessed by S-TDE.

Methods: This study prospectively included 175 patients with chronic coronary syndrome who were scheduled for elective PCI at a single tertiary-care center between April 2019 and November 2022. All patients had anginal symptoms with de novo, functionally significant, proximal left anterior descending (LAD) lesions and underwent fractional flow reserve (FFR)-guided elective single vessel PCI for LAD. Exclusion criteria were patients with reduced left ventricular (LV) systolic function (ejection fraction < 50%), periprocedural myocardial infarction as defined by the fourth universal definition of myocardial infarction.

Eligible patients underwent pre- (1 day before) and post-procedural (3 days after) LAD coronary flow assessments by S-TDE. Coronary flow velocity reserve (CFVR) was calculated as the ratio of the hyperemic peak diastolic flow velocity to the basal peak diastolic flow velocity. We also excluded the patients with suboptimal S-TDE imaging. We defined an RMVD after PCI as a post-PCI CFVR impairment (CFVR < 2.0).

Association between RMVD and echocardiographic parameters were evaluated.

Results: A total of 150 patients were included in the final analysis. RMVD was observed in forty-five (30.0%) patients after successful LAD PCI. Patients with RMVD had older age (74 [67-79] versus 72 [59-76], P = 0.042) and lower estimated glomerular filtration rate (eGFR) (58.4 [37.6-75.1] mL/min/1.73m² versus 65.9 [54.3-75.5] mL/min/1.73m², P = 0.045) than those without RMVD. Univariate logistic regression analyses revealed that higher age, lower eGFR, pre-PCI higher ratio of mitral peak velocity of early filling to early diastolic mitral annular velocity (E/e’), shorter deceleration time of diastolic coronary flow (DDT) and lower pre-PCI CFVR were associated with post-PCI RMVD. Multivariate logistic regression analyses including age and eGFR as covariates showed higher E/e’ (adjusted odds ratio [OR] 1.13, 95% confidence interval [CI] 1.02-1.25, P = 0.022), shorter DDT (OR 0.999, 95% CI 0.998-1.000, P = 0.045) and lower pre-PCI CFVR (OR 0.336, 95% CI 0.165-0.683, P = 0.003) were independently predictive of RMVD.

Conclusions: In patients with preserved LV ejection fraction who underwent successful elective FFR-guided PCI for LAD, pre-PCI LV diastolic dysfunction was associated with post-PCI residual microvascular dysfunction of LAD territory.