

Diagnostic value of myocardial perfusion CT to detect coexisting microvascular dysfunction in patients with obstructive epicardial coronary disease

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Background: The usefulness of computed tomography myocardial perfusion (CTP) to assess hemodynamically significant coronary artery lesions has been previously reported. However, the diagnostic value of quantitative evaluation of regional absolute coronary flow by CTP to detect microvascular dysfunction remains unknown.

Purpose: The aim of study is to assess the diagnostic value of preprocedural CTP to detect coexisting microvascular dysfunction with functionally significant epicardial stenosis in patients with chronic coronary syndromes.

Methods and results: Thirty-three chronic coronary syndrome patients with de novo single functionally significant stenosis (Fractional flow reserve [FFR] < 0.80) who underwent noncomplicated PCI were investigated. In CTP analysis, regional myocardial blood flow (MBF) at rest (rest-MBF) and hyperemia (hyperemic-MBF) were evaluated semi-automatically. Clinical characteristics, pressure-temperature sensor-chipped wire-based information and CTP findings were compared between groups with and without microvascular dysfunction defined by the index of microcirculatory resistance (IMR) (IMR ≥ 25, n = 17, IMR < 25, n = 16, respectively).

The determinants of coexistence of microvascular dysfunction and functional epicardial stenosis were determined. In invasive wire-based analysis, FFR, coronary flow reserve (CFR_{wire}) and IMR were 0.68 (0.57–0.72), 1.61 (1.00–1.98), and 26.7 (19.3–39.4) respectively.

In CTP analysis, rest and hyperemic-MBF and CFR derived from CTP (CFR_{CTP}; calculated as hyperemic-MBF/rest-MBF) were 2.00 (1.31–2.35) ml/min/g, 4.03 (2.11–5.44) ml/min/g, and 2.09 (1.49–2.09) respectively. In the lesions with IMR > 25, hyperemic-MBF was significantly lower than that in IMR < 25 (3.42 [1.89–4.34] vs 4.50 [3.44–5.99], p = 0.031), although there was no significant difference in regional rest-MBF and CFR_{CTP} (1.75 [1.31–2.24] vs 2.05 [1.35–2.46], p = 0.439, and 1.83 [1.21–2.11] vs 2.61 [1.91–2.91], p = 0.101 respectively). Receiver operating characteristic curve analysis of hyperemic-MBF detecting IMR > 25 showed area under the curve of 0.72 (0.54–0.90), sensitivity of 47% and specificity of 94%.

Conclusion: Quantitative assessment of absolute coronary flow by CTP may help detect coexisting microvascular dysfunction in patients with significant epicardial stenotic lesions.