High-risk plaque burdens myocardial flow reserve in intermediate coronary artery disease: hybrid analysis of 13N-ammonia PET and coronary CT angiography

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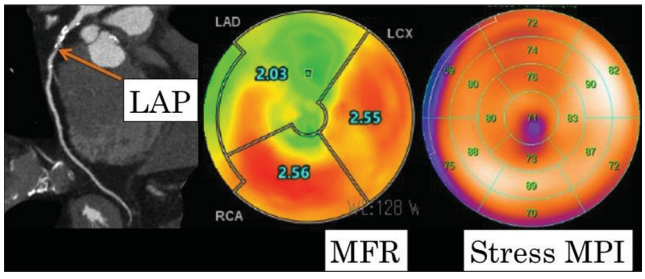
Background: 13N-ammonia PET (NH3-PET) can detect myocardial perfusion abnormalities in patients with coronary artery disease (CAD) and also obtain diagnostic quantitative values of absolute myocardial blood flow and myocardial flow reserve (MFR). Low MFR (MFR<2.0) is an independent prognostic factor for major adverse cardiac event in patients with ischemic and non-ischemic heart disease. A feature of low attenuation plaque (LAP) on coronary CT angiography (CCTA) has been known as high-risk plaque (HRP) for acute coronary syndrome even if there is no significant coronary stenosis. The presence of HRP potentially adversely affects MFR, but the hypothesis has not been elucidated.
Purpose: We aimed to investigate the affect of LAP to MFR in intermediate CAD.
Methods: One hundred five patients (age 67±9 years, 65% male) with CAD underwent NH3-PET and CCTA within 6 months between April 2015 and March 2019 were enrolled. Based on the results of CCTA, mild and moderate stenosis were defined as 1% to 49% and 50% to 69% stenosis. Ischemic territories for major three vessels were identified by stress/rest NH3-PET images. Finally, 194 coronary arteries with mild to moderate stenosis corresponding to non-ischemic territory were analyzed in this study. LAP was defined as plaques containing CT value less than 90HU. Partially calcified plaques were included in LAP. Entirely calcification plaque without LAP was defined as calcified plaque. MFR for major three vessels were calculated from dynamic scan at stress/rest NH3-PET.
Results: CCTA showed 80 coronary arteries with LAP (41%), 104 coronary arteries with calcified plaque (54%), 102 vessels with mild stenosis (53%), and 92 vessels with moderate stenosis (47%). MFRs for coronary arteries with LAP were significantly lower than those without LAP (2.1±0.6 vs 2.5±0.6, p<0.0001). The significant difference in MFR between with and without LAP was observed in both mild and moderate stenosis (mild: 2.0±0.6 vs 2.5±0.6, p=0.0015, moderate: 2.1±0.6 vs 2.5±0.6, p<0.0001). In contrast, coronary arteries with calcified plaque had significantly higher MFR than those without (2.5±0.6 vs 2.1±0.6, p<0.0001).
In 58 coronary arteries with MFR<2.0, 71% (41/58) had LAP and 24% (14/58) had calcified plaque. In 136 coronary arteries with MFR≥2.0, 29% (39/136) had LAP and 66% (90/136) had calcified plaque. LAP was significantly more frequent in the former and calcified plaque was significantly more frequent in the latter.
Conclusion: The presence of LAP burdens MFR in mild to moderate CAD. On the other hand, calcified plaque alone had no adverse effect on MFR. LAP is an important sign in CAD risk assessment even without significant coronary stenosis.



MFR and stress MPI