



Title: Fractal analysis of four-dimensional CT stress perfusion imaging to differentiate microvascular ischaemia and haemodynamically relevant coronary artery disease

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Topic: Cardiac

Presentation Format: Clinical Trials in Radiology

Purpose or Learning Objective:

Diagnosis of coronary microvascular ischaemia (CMD) is challenging, especially in the presence of mild to moderate coronary stenosis. We evaluated fractal analysis of four-dimensional CT stress perfusion imaging (4D-CTP) for differentiating CMD and haemodynamically relevant coronary artery disease (CAD) with a combined invasive and noninvasive reference standard in a multicentre setting.

Methods or Background:

From the prospectively conducted AMPLIFIED multicentre trial (7 sites), we retrospectively included patients with an indication for invasive coronary angiography (ICA) and suspected or known CAD. Patients underwent dual-source computed tomography angiography (CTA), 4D-CTP, CT delayed-enhancement imaging, and ICA with fractional flow reserve (FFR) measurement. A combination of ICA with FFR and CT-derived myocardial blood flow (MBF; either as absolute measurement or relative perfusion index) served as reference to define ischaemia. Subgroup analyses included ischaemic patients with non-stenotic coronary arteries (INOCA, $\leq 25\%$ stenosis) and patients with mild to moderate stenosis (26-80%).

Results or Findings:

From the included 118 patients, 84 showed signs of ischaemia. Fractal analysis differentiated CAD (n=61, 23% female) and CMD (n=23, 30% female) with sensitivity=95% and specificity=74%. In the subgroup of patients with non-stenotic coronary arteries (n=33, 14 females), fractal analysis identified INOCA (n=15) with sensitivity=100% and specificity=78%. In patients with mild to moderate stenosis (n=27, 4 females), CAD (n=19) was differentiated from microvascular ischemia with sensitivity=84% and specificity=100%.

Conclusion:

In the setting of a multicentre trial, fractal analysis of perfusion accurately differentiated between CAD and CMD including patients with normal coronary arteries and mild to moderate stenosis.

Limitations:

PET was unavailable for correlation with CT perfusion measurements and classification of CMD-subtypes (e.g., regarding endothelium-dependence) could not be performed.

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Has your study been approved by an ethics committee: Yes

Ethics committee - additional information: The study received institutional review board approval and written informed consent was obtained from all participants.

Area of Interest: Cardiac, Cardiovascular system

Imaging Technique: CT-Quantitative

Procedure: Fractal analysis

Special Focus: Arteriosclerosis, Ischaemia / Infarction