Whole-heart dynamic three-dimensional magnetic resonance perfusion imaging for the
detection of coronary artery disease defined by fractional flow reserve: determination of
volumetric myocardial ischaemic burden and coronary lesion location

Summary / Zusammenfassung
AIMS: Dynamic three-dimensional-cardiac magnetic resonance (3D-CMR) perfusion proved
highly diagnostic for the detection of angiographically defined coronary artery disease (CAD) and
has been used to assess the efficacy of coronary stenting procedures. The present study aimed to
relate significant coronary lesions as assessed by fractional flow reserve (FFR) to the volume of
myocardial hypoenhancement on 3D-CMR adenosine stress perfusion imaging and to define the
inter-study reproducibility of stress inducible 3D-CMR hypoperfusion.

METHODS AND RESULTS: A total of 120 patients with known or suspected CAD were
examined in two CMR centres using 1.5 T systems. The protocol included cine imaging, 3D-CMR
perfusion during adenosine infusion, and at rest followed by delayed enhancement (DE) imaging.
Fractional flow reserve was recorded in epicardial coronary arteries and side branches with ≥2 mm
luminal diameter and >40% severity stenosis (pathologic FFR < 0.75). Twenty-five patients
underwent an identical repeat CMR examination for the determination of inter-study
reproducibility of 3D-CMR perfusion deficits induced by adenosine. Three-dimensional CMR
perfusion scans were visually classified as pathologic if one or more segments showed an
inducible perfusion deficit in the absence of DE. Myocardial ischaemic burden (MIB) was
measured by segmentation of the area of inducible hypoenhancement and normalized to left
ventricular myocardial volume (MIB, %). Three-dimensional CMR perfusion resulted in a
sensitivity, specificity, and diagnostic accuracy of 90, 82, and 87%, respectively. Substantial
concordance was found for inter-study reproducibility [Lin's correlation coefficient: 0.98 (95%
confidence interval: 0.96-0.99)].

CONCLUSION: Three-dimensional CMR stress perfusion provided high diagnostic accuracy for
the detection of functionally significant CAD. Myocardial ischaemic burden measurements were
highly reproducible and allowed the assessment of CAD severity


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