Abstract:

The aim of this study was to investigate if a quantitative evaluation of a magnetic resonance (MR) perfusion examination of the myocardium can achieve a comparable diagnostic accuracy as a semiquantitative evaluation. A total of 31 patients with suspected coronary artery disease underwent MR imaging and conventional coronary angiography. Stenoses with a diameter reduction between 50% and 75% were evaluated by an intracoronary pressure wire examination (fractional flow reserve) for assessment of their hemodynamic relevance. A 0.05 mmol/kg contrast material bolus (gadopentetate dimeglumine) was applied during adenosine-induced stress (140 μg/kg/min) and at rest with a flow rate of 5 mL/s. Signal intensity time curves of the first-pass MR perfusion images, acquired at rest and under adenosine stress with a Saturation Recovery-turbo Fast Low Angle Shot Magnetic Resonance Imaging sequence, were analyzed by Argus Dynamic Signal Analysis (Siemens Healthcare, Erlangen, Germany). For the semiquantitative evaluation, the upslope value of a linear fit from the foot point to the signal maximum was calculated for 18 segments (signal intensity units per second). For the quantitative evaluation, a model-independent deconvolution was used to calculate coronary blood flow.
(MBF in mL/100 g/min). For each segment for the stress and rest examination, upslope value and MBF were determined. In addition, the ratio of the stress and rest value for each segment was determined (myocardial perfusion reserve index [MPRI]). The mean value of the 2 segments with the lowest value was calculated for each patient. Coronary artery stenosis greater than 75% or greater than 50% with positive fractional flow reserve less than 0.75 was considered as hemodynamically relevant. Receiver-operator-curves were calculated. The values of the area under the ROC curves were 0.74, 0.66, and 0.92 for the US(Stress), US(Rest), and US(MPRI) evaluations (semiquantitative evaluation). The values for the MBF(Stress), MBF(Rest), and MBF(MPRI) evaluations (quantitative evaluation) were 0.92, 0.68, and 0.84, respectively. Comparing US(MPRI) and MBF(Stress), identical values and no significant difference were found for the area under the ROC curves. A quantitative evaluation using a model-free deconvolution provides identical diagnostic performance when only a stress examination is used, much similar to a semiquantitative evaluation, if both stress and rest examinations are used.