The influence of myocardial blood flow and volume of distribution on late Gd-DTPA kinetics in ischemic heart failure.

Abstract:

PURPOSE: To determine the mechanism of enhancement of contrast-enhanced MRI (ceMRI) in chronic ischemic myocardium. While ceMRI can identify scar tissue in chronic ischemic myocardium, the mechanism of enhancement is not completely understood. MATERIALS AND METHODS: A total of 11 patients with ischemic heart failure (ejection fraction [EF] 28 +/- 9%) were imaged with ceMRI and positron emission tomography (PET) to measure myocardial blood flow (MBF). Longitudinal relaxation rate (T1) of blood, normal tissue, and scar tissue defined by ceMRI was determined before and two to 50 minutes after contrast (Look Locker technique), and the partition coefficient (lambda) and volume of distribution (VD) were calculated. RESULTS: In scar and viable tissue, T1 was significantly different over the whole period after contrast, but not before contrast. However, T1 of scar and blood were similar five to 15 minutes post contrast, making the detection of subendocardial defects difficult. Lambda reached an initial steady state in viable tissue, but was delayed (20 minutes) in scar tissue. VD in scar was double that of viable tissue (0.54 +/- 0.01 vs. 0.29 +/- 0.02, respectively) indicating an increased interstitial space. Contrast wash-in kinetics correlated moderately with MBF (r = -0.36), but well with the combination of MBF and VD (r = 0.59).
CONCLUSION: Late myocardial contrast kinetics depend on both MBF and VD; however the increased VD seems to be the main mechanism for the late enhancement effect.