Evaluation of Postcontrast T1-values of the Myocardium and Blood by 3D Look-Locker MRI: Comparison with 2D Look-Locker MRI

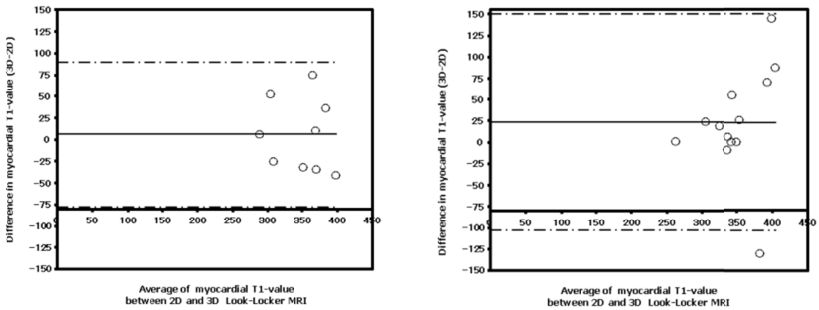
Yasuo Amano[1], Masaki Tachi[1], Yoshiaki Komori[2], Yuriko Suzuki[2], Tetsuro Sekine[1], and Shinichiro Kumita[1]

[1]Nippon Medical School, Tokyo, Tokyo, Japan, [2]Philips Electronics Japan, Tokyo, Japan

Introduction: Late gadolinium enhancement (LGE) MRI detects myocardial scar, but cannot identify diffuse myocardial fibrosis because of its binary contrast between the normal and scarred myocardium. 2D Look-Locker MRI or its modification can provide the information about presence and severity of the diffuse myocardial fibrosis in dilated cardiomyopathy, hypertrophic cardiomyopathy, and congestive heart failure, by measuring postcontrast T1-value of the myocardium. However, this 2D imaging technique cannot cover the whole myocardium in the left ventricle. The purpose of this study was to evaluate the technical feasibility of 3D Look-Locker MRI for the measurement of postcontrast T1-values of the myocardium and blood, by comparing with 2D Look-Locker MRI and LGE MRI.

Methods: Twenty-four patients with varied myocardial diseases underwent both postcontrast 2D and 3D Look-Locker imaging followed by 2D LGE MRI using a 1.5-T imager. These postcontrast MRI sequences were performed during a single breath-hold, and the 3D Look-Locker imaging provided the 6 imaging sections covering the whole left ventricle in the 4-chamber view plane. TR, TE, EPI factor, spatial resolution, SENSE factor and acquired cardiac phases were 8.1 ms, 3.8 ms, 7, 2.8 x 3.2 mm^2, 1.5, and 50 in the 2D Look-Locker MRI, whereas those of the 3D Look-Locker MRI were 11 ms, 5.1 ms, 11, 2.8 x 3.4 mm^2, 2, and 40. The scan ordering of 2D and 3D Look-Locker MRI was determined randomly. Differences and agreements for the postcontrast T1-values of the myocardium and blood were assessed between 2D and 3D Look-Locker imaging and between the two middle slices on the 3D Look-Locker imaging. The effect of the scan ordering on the myocardial T1-value measurement was also assessed. The ability to detect the myocardial scarring and its T1-value in the 3D Look-Locker MRI were assessed by comparing with those in the 2D LGE MRI.

Results: There were no significant differences in the postcontrast myocardial T1-values between 2D and 3D Look-Locker imaging. There were no significant differences in the postcontrast myocardial T1-values between the two slices on the 3D Look-Locker imaging. Bland-Altman analysis showed a better agreement for the myocardial T1-values in the cases where the 3D Look-Locker imaging was performed first (Figures). The T1-values of the blood after contrast were affected by the scan ordering. Namely, the imaging performed first provided a longer T1 value of the blood. The myocardial scars were detected in 5 of the 8 patients with the scarring by the 3D Look-Locker MRI and their T1-values (290ms) were shorter than those of the non-scarred myocardium (360ms).



Conclusion: 3D Look-Locker MRI may permit the estimate of postcontrast T1-values of the whole left ventricular myocardium during a single breath-hold. The 3D imaging should be performed at the fixed delay time (e.g., 10 min) after contrast for the measurement of the myocardial T1-value.

References: 1. Look DC, Locker DR. Rev Sci Instrum 1970; 41: 250. 2. Henderson E. MRI 1999; 17: 1163. 3. Iles L. JACC 2008; 52: 1574.

Figures The differences in postcontrast myocardial T1-values were smaller between 2D and 3D Look-Locker MRI, when the 3D Look-Locker imaging was performed first (left) than when it was performed second (right).