Effect of Blood T1 Value on Extracellular Volume Fraction in Dilated Cardiomyopathy with Septal Scarring

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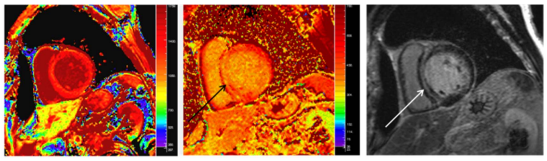
Target Audience physicians and scientists who are interested in T1 and ECV mapping

Introduction Late gadolinium enhancement (LGE) MRI identifies myocardial scarring related to adverse cardiac events and prognosis in dilated cardiomyopathy (DCM).[1] T1 mapping or extracellular volume fraction (ECV) measurement is expected toquantify the degree of fibrosis, which LGE cannot assess.[2] The blood T1 values as well as those of the myocardium before and after contrast should be measured to calculate ECV.[2] The right ventricular (RV) blood T1 value could be measured in cases of flow artifacts or turbulence in the left ventricular (LV) cavity, but the RV blood T1 and the effect of blood T1 value on ECV remain unknown. We assessed the effect of blood T1 value on the scarred and normal-appearing myocardial ECV in DCM by measuring the blood T1 value in both RV and LV cavities.

Methods The 14 DCM patients with septal LGE were enrolled. A 3.0 T MRI scanner (Philips) was used. Modified Look-Locker inversion-recovery (MOLLI) imaging was performed before and 10 minutes after 0.15 mmol/kg Gd injection. The 3-(3)-5 single-shot steady-state free precession sequence was used for MOLLI, and the imaging parameters were as follows: TR, 2.1 ms; TE, 0.86 ms; FA, 35°; bandwidth, 1898.5 Hz/pixel; in-plane resolution, 1.98 x 1.98 mm^2; slice thickness, 10mm; k-space segmentation, 81; and one signal excitation. Sensitivity encoding (factor = 2) and sequential ordering were used, and the delay time from an inversion recovery pulse ranged from 158 to 900 ms.

We measured the RV and LV blood T1 values and myocardial T1 values of the septal LGE and normal-appearing areas before and after contrast, and calculated ECV. First, we compared the pre- or postcontrast blood T1 values between the RV and LV cavities. Second, the ECV of the septal LGE or normal-appearing area was compared between when measuring the blood T1 value in the RV and LV cavities. Third, we compared the ECV between the septal LGE area and normal-appearing myocardium when measuring the blood T1 value in the RV or LV cavity.

Results (Table) The RV blood T1 value was significantly shorter than the LV blood T1 value (1741 ms vs. 1804 ms; P = 0.011; Fig. 1a). However, there was no significant difference in the postcontrast blood T1 value between the ventricles (Fig. 1b). The ECV derived from the RV blood T1 value did not differ from that derived from the LV blood T1 value for septal LGE area or normal-appearing myocardium. The ECV of the septal LGE was significantly greater than that of the normal-appearing area both when measuring the blood T1 value at the RV and LV cavities (Figs.1 b, c)



Discussion The precontrast blood T1 value was shorter in the RV than in the LV, which may reflect the difference in oxygenation of the blood between the ventricles. Nonetheless, the ECV of both LGE and normal-appearing areas were not affected by the ventricle where the blood T1 value was measured. The Gd injection, correction with hematocrit, and myocardial T1 may attenuate the effects of the precontrast blood T1 value on ECV.

Conclusion Although precontrast blood T1 values differ between the RV and LV cavities, the measurement in the RV blood T1 value can be feasible for estimating myocardial ECV in cases of flow artifacts or turbulence in the LV cavity.

Fig 1 a. Precontrast MOLLI shows the RV blood T1 is shorter than the LV blood T1 before contrast. b. After Gd contrast, the blood T1 is similar between the RV and LV. c. Septal LGE has shorter T1 and larger ECV (arrow in b and c).

References 1. Assomull RG. JACC 2006; 48: 1977-85. 2. Kellman P. JCMR 2012; 14: 64.

	pre blood T1	post blood T1	ECV of LGE	ECV of normal
RV	1741ms	419.1ms	37.60%	30.7%
LV	1804ms	418.3ms	37.30%	30.4%