

WORKSHOP PRESENTATION

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Cardiac T1 mapping in congenital heart disease: bolus versus infusion protocol for measurement of myocardial extracellular volume

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Background

Measurement of myocardial extracellular volume fraction (ECV) with T1 mapping cardiac magnetic resonance (CMR) before and after the application of a gadolinium-based extracellular contrast agent enables the assessment of diffuse myocardial fibrosis. The equilibrium between blood and myocardium contrast concentration required for ECV measurements can be achieved with a primed contrast infusion (equilibrium contrast-CMR). In healthy volunteers it could be shown that a single bolus may also be sufficient to reach equilibrium. We hypothesized that equilibrium between blood and myocardium contrast distribution can be achieved with the bolus-only technique to accurately measure diffuse myocardial fibrosis in patients with congenital heart disease (CHD).

Methods

A study group of 23 patients with CHD (age range 14 - 45 years, mean age 25.8 years) was compared with 17 healthy volunteers (age range 23 - 30 years; mean age 25.1 years). Using modified Look-Locker inversion recovery (MOLLI) T1 mapping before application, 15 minutes after bolus injection, and during constant infusion of Gd-DOTA, T1 values were obtained for blood pool and myocardium of the interventricular septum (IVS), the left ventricular (LV) antero-/lateral wall, and the inferior or anterior wall of the right ventricle (RV) in a single midventricular plane in short axis or in transverse orientation.

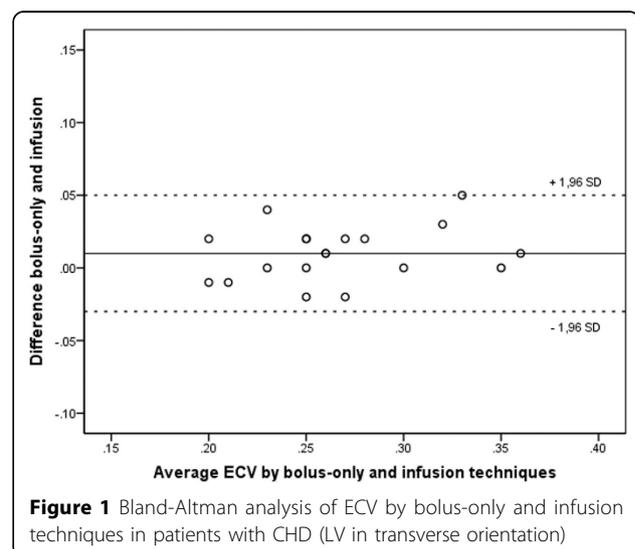
Results

In CHD patients, correlation between ECV by bolus-only and infusion was strong for IVS, LV and RV ($R^2 = 0.88$,

0.85, and 0.79, respectively). ECV of IVS, LV and RV by both techniques correlated strongly in healthy volunteers ($R^2 = 0.91$, 0.81, and 0.74, respectively). Bland-Altman plots did not show significant bias between the techniques in patients and healthy volunteers for any of the analyzed regions (Figure 1).

Conclusions

Based on T1 mapping, ECV of LV and RV myocardium can be measured accurately by the bolus-only technique in patients with CHD. The use of a bolus-only approach facilitates the integration of ECV measurements into clinical CMR routine workflow across a wide range of CHD.



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