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Clinical application of MOLLI T1* for extracellular volume calculation in healthy volunteers and aortic stenosis

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Background

The calculation of the extracellular volume fraction (ECV) requires accurate quantification of myocardial and blood pool T1. Some Modified look locker inversion recovery (MOLLI) sequences provide a T1 and T1* output. T1* does not use a look locker correction, and so it is theoretically a more accurate estimation of true T1 blood T1 because fresh spins are flowing into the imaging plane. It is therefore recommended to use T1* for the quantification of the pre- and post-contrast blood pool. The aim of this study was to investigate the effect on ECV of using T1* (ECV_{T1*}) rather than T1 (ECV_{T1}) and assess accuracy, precision and bias.

Methods

57 patients with aortic stenosis (AS) (mean age= 71±10 years, 33 female) and 25 healthy volunteers (HV) (mean age= 40±11 years, 19 female) were recruited. 4 chamber and mid ventricular short axis (SA) T1 maps were acquired pre-contrast and 15 minute post-contrast using 5s(3s)3s and 4s(1s)3s(1s)2s sequences respectively. Regions of interest (ROI) were drawn carefully to avoid blood-myocardium border and copied across series with correction only for patient movement. ECV was calculated as ($\Delta[1/T1_{myo}]$ / $\Delta[1/T1_{blood}]$) * (1-haematocrit).

Results

ECV_{T1*} was significantly lower than ECV_{T1} (mean 27.1 ±3.4% vs 28.1±3.2%, p<0.0001). ECV_{T1*} showed excellent correlation with ECV_{T1} (R= 0.88) (Figure 1). Bland-Altman analysis revealed no bias or variability (Figure 2). There was no statistical difference in variance between groups

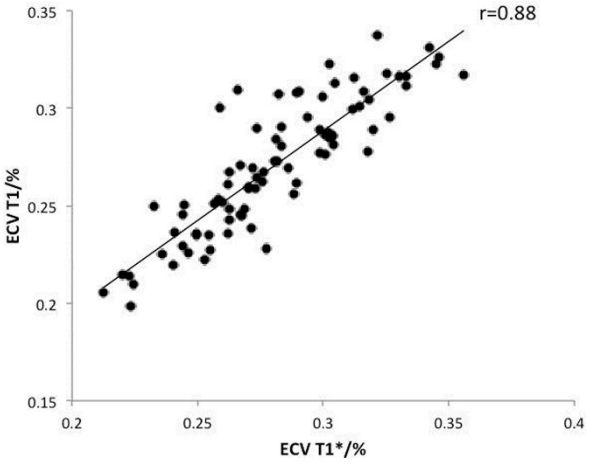

Figure 1 Excellent correlation between ECV BloodT1 and ECV BloodT1*

(F test, p= 0.66). In this group of subjects there was no difference in ECV between AS and HV groups using either ECV_{T1} (28.1±3.2% vs 28.2±3.4%) or ECV_{T1*} (27.3±3.6% vs 26.5±3.0%).

Conclusions

ECV quantification using T1* can measure ECV across disease and normal populations, but its own normal values need to be referenced. It has similar variability, and no bias when compared to ECV using $T1_{blood}$. ECV_{T1*} is therefore practically feasible and encourages further work to explore its theoretical accuracy by histological correlation.

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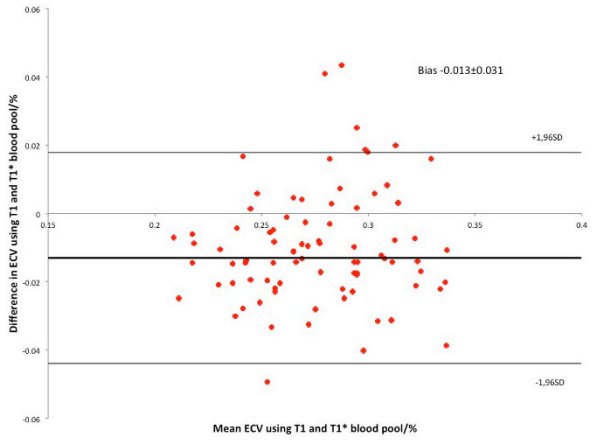

Figure 2 Little bias and variability between ECV BloodT1 and BloodT1* using Bland-Altman analysis

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