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Poster presentation

The use of parallel imaging techniques for the measurement of T2* decay

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Introduction

The measurement of T2* has been established as a rapid, reproducible non-invasive method for assessing iron loading in the heart and liver. For the heart, two CMR sequences are used routinely. The first is a 'bright-blood' multi-echo, single breath-hold acquisition in early systole. The second 'dark-blood' sequence is acquired in late diastole with a double inversion-recovery pre-pulse to null the blood pool giving enhanced blood/myocardial delineation. The long breath-hold times (up to 20 seconds) can be difficult for some patients, resulting in impaired image quaility.

Purpose

This study was designed to investigate whether the use of integrated parallel acquisition techniques (iPAT) to shorten acquisition times would affect the measurement of T2* decay.

Methods

65 patients (age 32 ± 16 years, 49% male) undergoing routine clinical assessment of iron loading were scanned using a 1.5 T MRI scanner with ECG gating and a cardiac phased array coil (Siemens Sonata, Erlangen, Germany). Three separate timed acquisitions (bright-blood cardiac T2*, dark-blood cardiac T2* and liver T2* sequences) were performed for each patient both with and without parallel imaging using GRAPPA (generalised autocalibrating partial parallel acquisition), iPAT factor 2. T2* decay was calculated using dedicated software (CMRtools, Cardiovascular Imaging Solutions, London, UK). Myocardial T2* was assessed using a region of interest in the septum of a single mid-ventricular slice. Hepatic T2* was measured from a region of interest in an area of homogeneous tissue in a single transverse slice through the liver. Truncation of the decay curve was used to correct for background noise. T2* values were compared using a paired, 2-tailed T test. P values of < 0.05 were defined as significant.

Results

Five patients were excluded from the final analysis due to artefact which precluded the measurement of T2*. Although subjectively the images were of inferior quality when parallel imaging was used, there were no significant differences in T2* measurement between non-parallel and parallel sequence acquisitions (see Table 1, 2). The addition of parallel imaging shortened the breath-hold times by an average (± SD) of 4.3(2.1), 4.8(2.3) and 4.2(1.6) seconds for bright blood, dark blood and liver T2* acquisitions respectively (see table 2).

Conclusion

Our results show that parallel imaging using GRAPPA is able to provide significant time saving for cardiac and hepatic T2* acquisitions without affecting the measurement of T2* decay. The coefficient of variation observed is only marginally higher than previously published data on inter-observer and inter-study variability using breath-hold sequences without parallel imaging.

Table 1: Summary of T2* values for each sequence

Sequence	Routine acquisition (mean ± SD) ms	With parallel imaging (mean ± SD) ms	P value	Coefficient of variation (%)
Cardiac T2* bright blood	29.5 ± 12.6	29.8 ± 12.9	0.37	8.16
Cardiac T2* dark blood	26.02 ± 10.4	26.28 ± 10.6	0.14	5.31
Hepatic T2*	5.7 ± 4.8	5.8 ± 4.6	0.20	4.81

Table 2: Breath-hold times for each sequence

Sequence	Routine acquisition (mean ± SD) s	With parallel imaging (mean ± SD) s	P value
Cardiac T2* bright blood	16.9 ± 3.8	12.2 ± 2.4	< 0.001
Cardiac T2* dark blood	19.8 ± 4.5	14.5 ± 3.3	< 0.001
Hepatic T2*	14.5 ± 1.7	9.8 ± 0.8	< 0.001

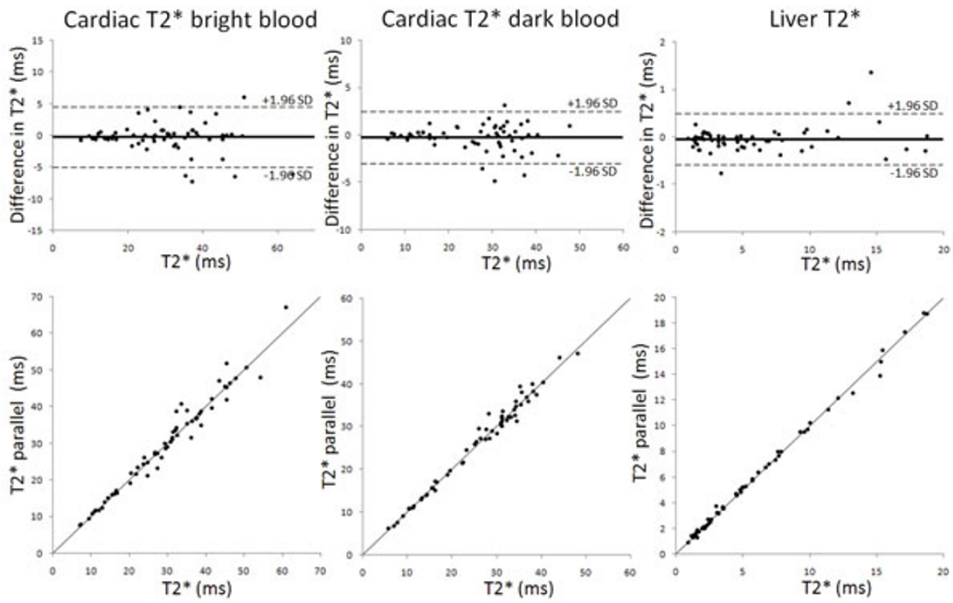

Figure 1
Bland-Altman plots (top row) and scatter plots (bottom row) showing comparison of parallel and non-parallel T2* acquisitions.