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Quantification of myocardial perfusion MRI using radial data acquisition: comparison of Ktrans from dual-bolus and T1 estimation methods

Tae Ho Kim, Nathan Pack, Liyong Chen and Edward DiBella*

Address: University of Utah, Salt Lake City, UT, USA

* Corresponding author

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Introduction

Myocardial perfusion MRI is a useful modality to detect myocardial ischemia. Quantitative perfusion estimates require an accurate arterial input function (AIF). Recently, a method for estimating T_1 and thus gadolinium concentration from a radial k-space perfusion sequence was proposed [1]. The method created four sub-images with differing effective saturation recovery times (eSRTs) from 96 ray acquisitions to estimate T_1. No measures of truth were used to evaluate the method *in vivo*. In this work, we employ a similar technique for obtaining T_1 estimates and compare to perfusion estimates from a dual-bolus method, a current standard for quantifying myocardial perfusion [2].

Methods

Perfusion MRI studies were performed on Siemens 3 T Trio and Verio systems. 12 subjects (8 female, 4 male) without ischemia were given a low dose (0.004 mmol/kg) of dilute (1/5 concentration) contrast agent (CA: Gd-BOPTA) and then a higher non-dilute dose (0.02 mmol/kg). In two subjects, an additional dose (0.06 mmol/kg) was used. We employed a saturation recovery radial turboFLASH sequence with 72 rays acquired in an interleaved manner, TR/TE = 2.6/1.14 msec, flip 14° and slice-thickness 8 mm. We used an iterative total variation constrained reconstruction on 72 rays for tissue curves and on two subsets of 24 rays [3]. T_1 estimates were obtained from the blood signal in the two sub-images using the equation in [1] and the resulting T_1 curves of the AIFs were converted to concentration curves to remove the saturation effects. The images from 72 rays were processed to obtain 6 tissue curves per slice. A 2-compartment model was used to determine K^{trans}.

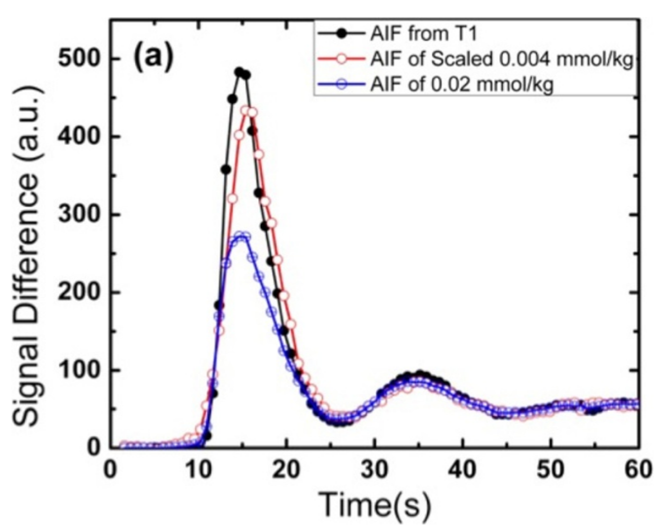

Figure 1
Saturated AIF from the higher dose CA injection is shown in blue. The upscaled low dose AIF (volume matched and 1/5 the concentraion of the blue curve), was scaled up by 5 and is shown in red. The AIF obtained using the T1 estimates from the multi-SRT images of the 0.02 mmol/kg scan is shown in black. The peak of the measured AIF from the 00.2 mmol/kg scan is saturated approximately 30% relative to the low dose AIF. The multi-SRT AIF is similar to the low dose AIF.

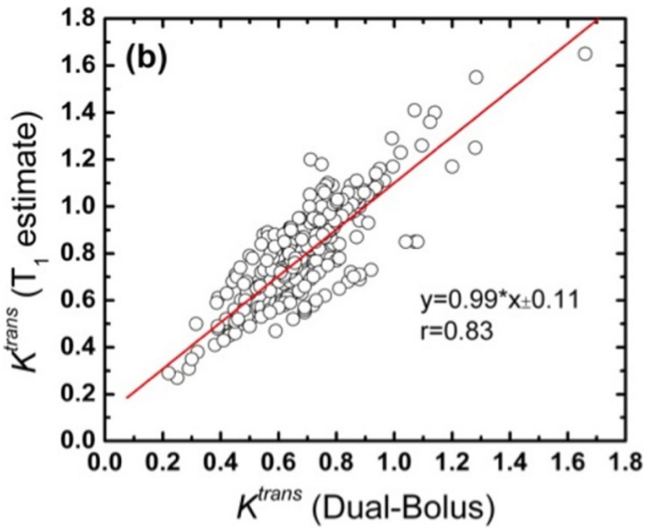

Figure 2
The linear fit relationship of K^{trans} using the dual-bolus and the multi-SRT T_1 estimation methods. 18 values for each of the 12 subjects are plotted (6 regions per slice, 3 slices).

Results

The proposed T_1 method gave AIFs that were similar to those obtained with the dual-bolus method (Fig. 1). K^{trans} values estimated from the dual-bolus and the proposed T_1 methods were 0.68 ± 0.18 and 0.79 ± 0.22, respectively. (Fig. 2) shows the K^{trans} values from the new method correlate well (r = 0.83) with the dual-bolus method.

Conclusion

The multi-SRT T_1 estimation method using an undersampled radial k-space perfusion sequence accurately quantifies myocardial perfusion for moderate (20~50%) saturation of the AIF. The method appears to also work well for higher doses (0.06 mmol/kg) although further study is needed. Unlike the dual-bolus method, the multi-SRT method requires only a single CA injection, which can greatly simplify stress studies.

References

1. Kholmovski , DiBella : *MRM* 2007:821-7.
2. Christian T, *et al.*: *JMRI* 2008:1271-77.
3. Adluru G, *et al.*: *JMRI* 2009:466-73.