Evaluation of the Reproducibility of Intrarenal R2* Maps at 3.0T

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INTRODUCTION MRI maps of R2* (or T2*) have been shown to provide a new method for monitoring intrarenal oxygenation noninvasively. In this study we tested the reproducibility of BOLD-MRI R2* mapping at 3T with a multiple gradient-echo sequence in 8 healthy volunteers.

METHODS Eight healthy young subjects (four females and four males, mean age 25.6 ±4.1 years) participated in this study. None of the subjects had any known history of renal disease. We conducted the experiments on a GE 3.0T whole-body scanner (Milwaukee, WI) using a multiple gradient-echo (mGRE) sequence (TR/TE/flip angle/BW =100/7.3– 32.7 msec/45/31.25 kHz) to acquire 12 T2*- weighted images within a single breath-hold of about 16 seconds. The matrix size was 128× 96 with a field of view (FOV) of 36 cm and 0.75 phase FOV. A standard eight-coil torso array was used for signal reception. To determine the reproducibility of the renal R2* map, all subjects were studied two times within one week. The spin-spin relaxation constant R2* (=1/T2*), which is closely related to the content of deoxyhemoglobin in blood, was used as a BOLD parameter. We constructed R2* maps using FUNCTOOL, by fitting a single exponential function to the signal intensity vs.echo time (TE) data. Regions of interest (ROIs) covering at least 20 pixels were drawn on the anatomic template. Typically, 10–20 ROIs for each cortex and medulla were obtained from several slices and both kidneys. We combined the data to obtain a single representative mean value of R2* per subject. For assessment of the limits of agreement and reproducibility, Pearson's correlation coefficient and Bland-Altaman's analyse were adapted. We also compared the R2* values on both examinations using the coefficient of variance (CV) obtained by calculating the overall standard deviation (SD) divided by the mean of different examinations.

RESULTS No major distortion artifacts or ghosting artifacts were observed and cine movies of the slices demonstrated that there was no movement during the imaging. A representative coronary R2* map is shown in Figure 1. The mean R2* values were 15.51±1.19Hz in cortex and 34.96± 1.51Hz in medulla. The intraindividual CV between two examinations was 4.1% in the medulla, and 5.8% in the cortex. Bland-Altaman's analyse showed that there was a good agreement between both renal R2* values measured by two different BOLD scans (Fig 2).

CONCLUSIONS In conclusion, the major findings of this study were that R2* could be measured in a reproducible way in the renal medulla and cortex at 3T.

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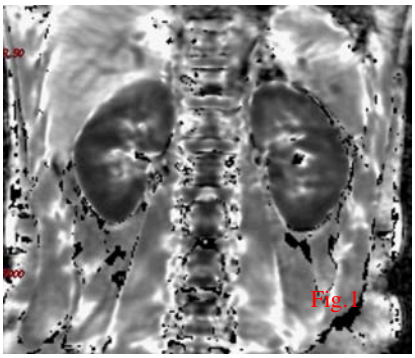

Fig.1

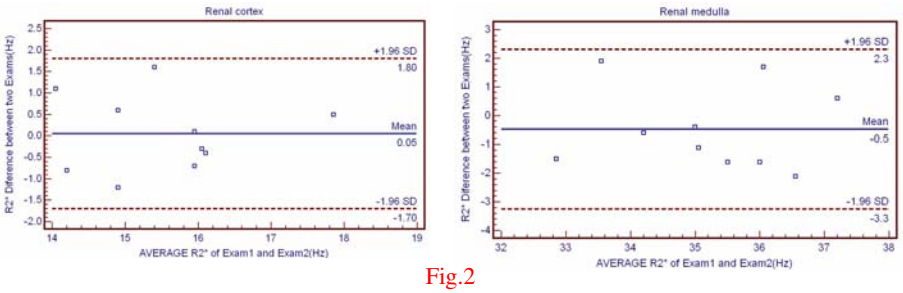

Fig.2

Fig.1: A coronary R2* map of kidney

Fig.2: Bland and Altman plot of the first and second R2* values measurements in renal cortex (the left) and medulla (the right)

References:

1. F.H. Epstein et al., Diabetes Care, 2002, 25(3): p. 575-78

2. Prasad, P. V. et al., J Magnetic Resonance Imaging, 2004.20:p.901-04.

3. Prasad, P. V. et al., Circulation. 1996 Dec 15; 94(12): 3271-5.

4. R. K. Garugu1 et al, J. Proc. 13th ISMRM, p1910, 2005