Rapid 3D T1-mapping in the abdominal region at 3.0 T

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Purpose/Introduction

In MRI quantitative measures are not frequently used. Mapping of T1-relaxation values is normally not implemented in routine clinical practice, though for brain imaging several successful protocols have been presented. Rapid T1-mapping in the abdominal region is difficult because of time limitations and proneness to motion artefacts. Quantitative T1-measurement in this region is however of clinical importance for quantification of contrast agent concentration in suspected lesions.

Subjects and Methods

T1-measurements in multiple slices were performed with the classical Look-Locker (LL) sequence in combination with a segmented 3D Turbo Field Echo sequence and implemented on a Philips 3.0 T Intera scanner with a matrix size of 128x128, slice thickness of 7 mm and alpha flip angle of 8 degrees. The total number of slices in the acquired volume amounted to 8. Phantom measurements showed good agreement between T1-values as derived with imaging and spectroscopy.
T1-maps in the abdominal region were acquired after intravenous administration of Gadodiamide (Omniscan) in one breathhold during a MR-bowel imaging procedure (20 mg of butylscopamine bromide was administered intravenously to prevent peristalsis and a 1.5 liter of a Mannitol-LBG solution was ingested to distend the small bowel). 18 alpha pulses with an interpulse interval of 82 ms were applied within a TR of 1.8 s. In total 15 inversion pulses (shots) were used, resulting in an overall scan time of 27 seconds. The short scan time of 27 seconds could be achieved by using parallel imaging (SENSE factor of 2.5), acquisition of multiple profiles (TFE factor of 17) and scan reduction (scan percentage of 50 %). T1-maps were produced off-line using home written software (using IDL) that interpolates the LL recovery curves and calculates T1-values.

Results

The T1-maps acquired before and after contrast agent injection were of good quality in all slices. Calculating difference T1-maps reveals contrast agent uptake in muscle, bowel wall and kidney.

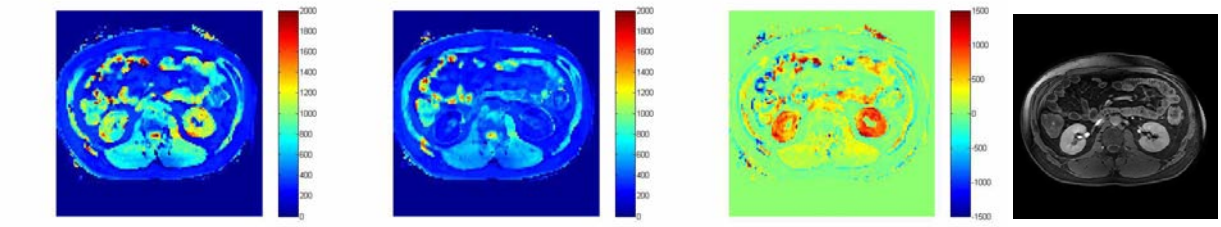

Figure 1: T1-maps before and after contrast agents injection (left panels), T1 differences per voxel (third panel) and anatomical T1-weighted images after contrast agent injection. Considerable uptake is visible in the kidneys. In the difference T1-map artifacts are visible for this patient due to intrascan motion.

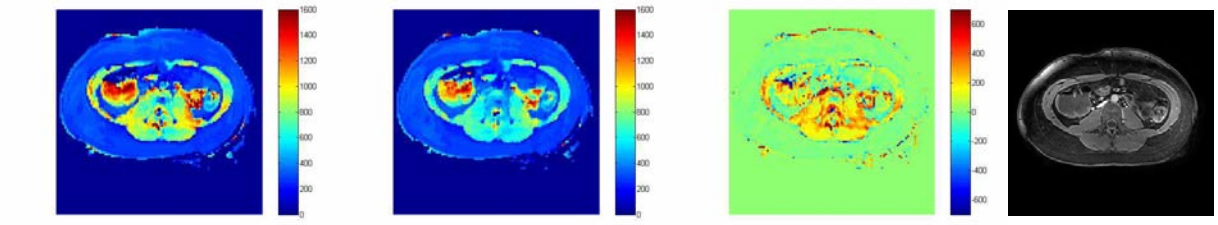

Figure 2: T1-maps before and after contrast agents injection (left panels), T1-differences per voxel (third panel) and anatomical T1-weighted images after contrast agent injection. Uptake is visible in muscles and bowel wall, though no pathological enhancement was observed by the radiologist in this slice.

Discussion/Conclusion

We have shown the feasibility of rapid T1-mapping in the abdominal region. This technique allows for quantitative assessment of contrast agent concentration, thus permitting permeability imaging in areas that suffer from important motion problems. Future research will focus on the correlation of Gadolinium concentration and histopathological findings. Furthermore, as intrascan motion of the patient may become an issue, we will address the application of non-linear image registration between pre and post contrast T1-maps.