Ultra Fast T2-weighted-sequences using variable refocusing angle with SENSE at 3T

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Objectives: Due to their insensitivty to susceptibility effects Turbo Spin-echo (TSE) sequences appear to be very attractive for high field applications. However their application at 3T interfere with high RF power deposition, especially ssh-TSE sequences suffer from that. It is well known that the SAR reduction can be obtained by using parallel imaging (SENSE) and half Fourier (HS). Nevertheless, very often a shorter acquisition time is requested. Here we present a new method, which is designed to provide high spatial resolution T2-w. images in a very short scan time by reducing SAR considerably. 5 volunteers and 50 patients were examined with this new method at 3T.

Methods: SAR can be reduced by the application with parallel imaging techniques like SENSE and with variable refocusing pulse angles. The variation can be obtained as a sweep along the echo train (flip angle sweep = FAS). We used this sequence in single shot modus in combination with half Fourier technique. This sequence was implemented on two clinical 3.0T scanners (Intera with 30mT and Achieva with 80mT gradient system, Philips Medical Systems, NL) and evaluated in 5 volunteers using an 6-channel surface coil. The image quality was acquired by variation of FAS from 30° - 180° in 15° increments and SENSE-factor from 1 – 4. The best parameter combination (SENSE-factor 3, TR/TE 4813/100ms, FAS 75°, voxel size 0.70 x 1.00 x 4.00mm and 29 axial slices) was used for the following patient (50) study. We compared the image quality and the tissue contrast of different anatomical structures with our 1.5T (1.5T Intera, Philips Medical Systems).routine images which were performed with the same spatial resolution. The resulting scan time was 38.5 seconds instead of 243 seconds of the 1.5T routine sequence.

Results: Blurring artifacts impaired the diagnostic image quality with SF < 3. The optimal FAS value was found at 75° considering SNR and RF-deposition. The contrasts between muscle and different anatomical structures were similar for both sequence types, except for fluid containing structures. The image quality was comparable and motion artifacts were significantly reduced. The scan time is about 6 times faster than the conventional TSE sequence.

Conclusions: We have presented and successfully implemented a new method, FAS-ssh-TSE with SENSE, which enables T2-w. MR-imaging with high spatial resolution and very short scan time. This new method produces images with similar contrast and diagnostic quality. Ssh-TSE combined with HS, SENSE and FAS is a very useful technique in the clinical routine especially by using high number of slices.

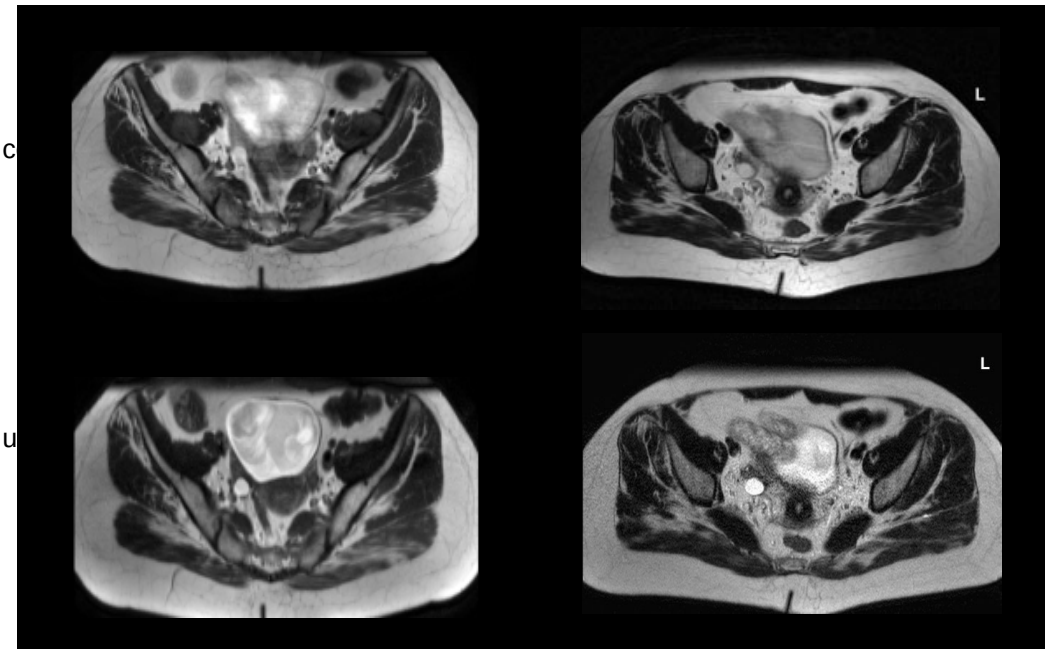

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Figure

Patient images with

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