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3D flow-insensitive vessel wall imaging using T2-prepared SSFP with PSIR

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Introduction

Double Inversion Recovery (DIR) [1] and Flow Sensitive Diffusion (FSD)[2] have been used to in vessel wall imaging. However, the "black blood" effect of DIR and FSD depends on the inflow, which is sensitive to slow or in-plane flow. In this work, T1, T2 difference between blood/vessel wall was exploited using a T2-prepared non-selective inversion preparation for flow-insensitive vessel wall imaging. To alleviate the dependence of blood/vessel wall contrast on the choice of TI and heart rate in ECG-triggered data acquisition, a Phase Sensitive Inversion Recovery (PSIR) [3] approach was used.

Fig. 1 Pulse diagram and magnetization change.

Theory

A T2-preparation module was added before the inversion recovery of PSIR to improve contrast. In the T2PSIR module, a 90° tip-down-pulse was used instead of the -90° tip-up-pulse to include the inversion effect into the T2-prep. After a nominal TI of the T2IR module, a 3D SSFP acquisition with high flip angle (80°) was used to acquire data. With the same TI, another SSFP acquisition of low flip angle (8°) was played after the 2nd ECG trigger pulse, same in DE PSIR (Fig. 1). Because the T2 preparation and inversion pulses are all non-selective, this technique provides a flow-insensitive feature.

Methods

The peripheral arteries were imaged in seven healthy subjects on 3.0 T (Trio, Siemens). An ECG-triggered, 3D SSFP segmented T2PSIR sequence was used for acquisition. Parameters used were: TE 1.8 ms, TR 3.6 ms, TI 350 msec, T2preparation time 40 ms. resolution $0.7 \times 0.7 \times 2.0$ mm, 32 slices, 30 k-space lines per segments, bandwidth 610 Hz/pixel with GRAPPA acceleration factor of 2.

Results

Fig 2 shows one slice with transversal view and the MPR image. Clear depiction of vessel wall can be found. The average CNR between vessel wall and lumen is 27.

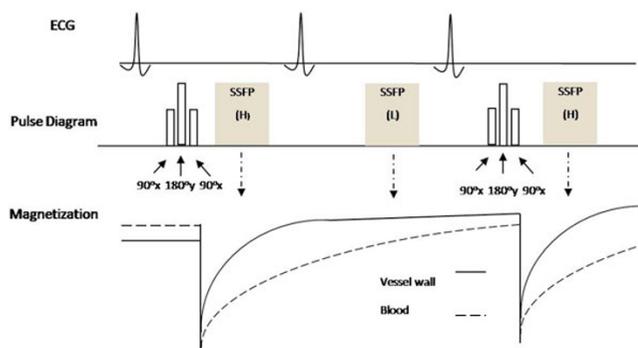


Figure 1

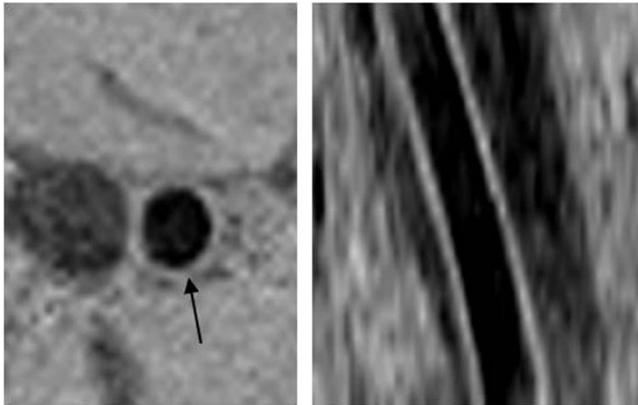


Figure 2

Fig. 2 (a) cross-sectional view of one volunteer (arrow pointed). (b) MPR image reformatted from the same volunteer.

Discussion and Conclusion

We have demonstrated a new technique that can achieve 3D flow-insensitive vessel wall imaging. This technique can acquire 64-mm-coverage in 4 minutes and has substantially improved imaging efficiency than single slice DIR method. More importantly, this technique is flow and TI-insensitive because of PSIR preparation. Further optimization of the technique is required to optimize CNR.

References

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