First-Pass Myocardial Perfusion Imaging with TSENSE

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PURPOSE

For perfusion application we need a temporal resolution as good as possible. A new accelerated first-pass myocardial perfusion imaging using adaptive TSENSE has recently been developed [1]. This technique is based on a T1-weighted TrueFISP sequence and reduces data acquisition in a dynamic fashion without any extra central *k*-space lines.

MATERIALS AND METHODS

First-pass myocardial perfusion magnetic resonance imaging (MRI), using adaptive TSENSE, was performed in 9 patients with coronary artery disease. Studies were performed on a 1.5 Tesla MR-scanner (Siemens Sonata) using a 2 × 6 channel body array coil. Image acquisition was started at the moment of the administration of a contrast bolus (Dotarem, 0.5 mmol/kg, 4-8ml/sec) followed by a saline chaser. Image acquisition consisted of 3 short axis images and 1 long axis image for every heartbeat, during 70 heartbeats using TSENSE (40 × 40 cm^2 FOV, 57 × 128 matrix, 12 cm slice-thickness, 10^0 readout flip-angle, TI = 112 ms, TR = 158, and a 440 Hz/pixel bandwidth). Acceleration rate of 2 was used to obtain 128 line resolution using 64 phase encodes acquired in a single heartbeat. Acquisition was performed during breath-hold for as long as possible. In TSENSE, alternate lines of data are acquired on alternate heartbeats. Data is shared and averaged across cycles to estimate coil sensitivity maps, as shown in Figure 1.

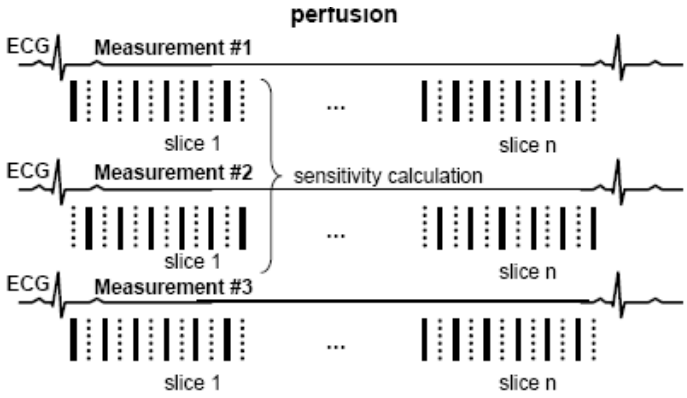

Figure 1 Data from sequential measurements of the same slice are combined and averaged across cardiac cycles for coil sensitivity estimation. Solid lines are acquired phase-encoding lines and dotted lines are skipped.

RESULTS

In all the 9 patients TSENSE images showed a sufficient image quality with respect to resolution and SNR. One patient showed a perfusion defect in the left circumflex artery (LCX) flow area (Figure 2). In this study we observed a significantly higher SNR and temporal resolution than in existing sequences such as TrueFISP and TurboFLASH. This corresponds to findings in one patient in whom a perfusion defect could be observed.

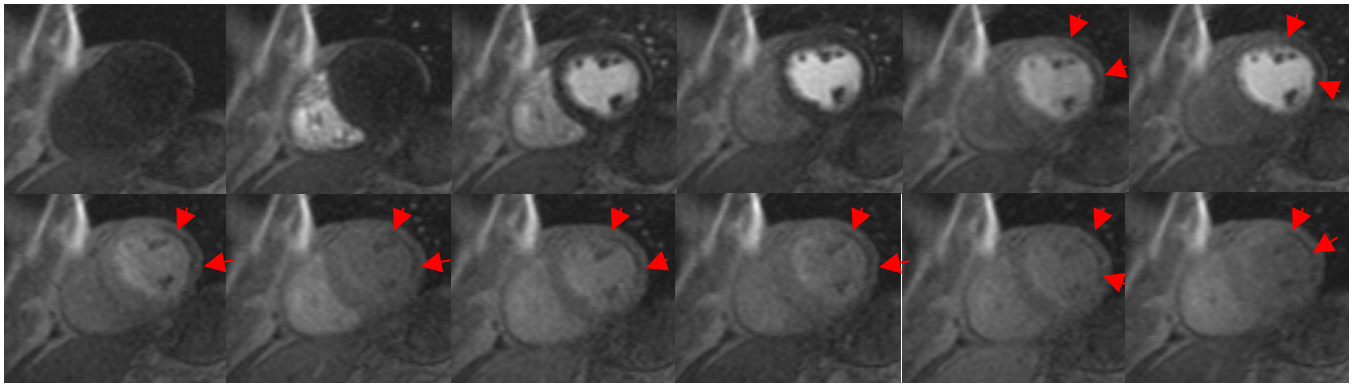

Figure 2: First-pass myocardial perfusion Short axis images at the mid ventricular level, of a 45-year-old male patient with a left circumflex artery (LCX) occlusion. The arrows indicate the perfusion defects in the LCX flow area (arrows).

CONCLUSION

We have presented an evaluation of contrast-enhanced perfusion imaging in which the results show superior image quality, high SNR and CNR. Moreover, the temporal resolution was found to be higher with TSENSE, resulting in an increased sensitivity for detection of perfusion defects.

REFERENCES

[1] Kellman P, et al. MRM. 2001; 45(5): 846-52.