Real-time Cardiac Imaging at 3T Using Wideband SSFP

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Introduction: SSFP cardiac imaging at 3T is limited by the short TR it requires, to avoid off-resonance artifacts. Wideband SSFP (wbSSFP) [1] allows a TR longer than 1/BW and enables the use of time-efficient readout schemes. In this work we demonstrate real-time wbSSFP at 3T with multi-shot EPI readouts.

Methods: Three-echo EPI readouts (3.2ms duration) were implemented within gradient echo (GRE), SSFP and wbSSFP sequences using a custom real-time imaging system [2]. Temporal resolutions were 169 ms, 159 ms, and 217.5 ms respectfully. Localized linear shimming was used.

Results: wbSSFP sequence with multi-shot EPI readout (TR/TRs = 5.1/2.4 ms) suppressed off-resonance banding and flow transient artifact in left ventricle compared to conventional SSFP with the same readout duration (TR = 5.5ms). wbSSFP also exhibited a more consistent blood-myocardium contrast compared to GRE.

Discussion: In wbSSFP, the high SNR efficiency of SSFP is used in exchange for an extended time-efficient readout. With wbSSFP, we have demonstrated free-breathing real-time cardiac imaging with T2/T1 blood-myocardium contrast at 3T. Reduced flow and motion artifact can be expected if spiral readouts are used.

[1] Nayak et al., ISMRM 2005 p.2387
[2] Santos et al., IEEE EMBC 2004 p.1048-1051