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Meeting abstract

1137 Single-shot, dark-blood, T2-weighted, inversion-recovery CMR with spin echo – echo planar umaging (DB-STIR EPI)

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Introduction

Acute myocardial infarction and other causes of myocardial edema are best visualized by dark blood STIR-TSE turbo spin echo (DB-STIR TSE) [1,2]. However, this segmented technique is sensitive to arrhythmia and respiratory motion. Single-shot dark blood HASTE (DB-STIR HASTE) eliminates the need for patient breath-hold, but the longer echo train further increases sensitivity to cardiac motion, which can lead to myocardial signal dropout [3]. Single-shot SSFP based techniques have been proposed [4], but the bright blood pool may affect endocardial border depiction, and the lack of STIR contrast has yet to be evaluated. We propose a single-shot dark-blood STIR prepared spin-echo echo-planar imaging (DB-STIR EPI) sequence with parallel acquisition technique (PAT) to reduce sensitivity to cardiac motion.

Purpose

To develop a single-shot DB-STIR EPI technique for edema imaging of the heart, and compare its soft tissue contrast and sensitivity to cardiac motion to DB-STIR HASTE in healthy volunteers.

Methods

Sequence

A single shot spin echo EPI sequence was developed on a 1.5 T clinical system (Avanto, Siemens Medical Solutions, Erlangen) incorporating dark blood and slice selective inversion preparation pulses. The coil sensitivity map required for GRAPPA PAT was acquired in a separate heart-beat to minimize echo train length.

Imaging

3 healthy volunteers gave informed consent to participate in this IRB-approved study. The subjects were scanned to optimize sequence parameters and compare the contrast and motion sensitivity of DB-STIR EPI with DB-STIR HASTE. (Table 1). The high fluid content of spleen gives it a significantly longer T1 and T2 than liver; therefore liver-spleen contrast was used to visually evaluate the sensitivity of each sequence to tissue fluid. Sensitivity to cardiac motion was investigated by testing each sequence at 2 different trigger delays (TD). The TD was first optimized for uniform myocardial signal intensity for each patient, and then adjusted by -50 msec to shift the acquisition window to an earlier period of diastole with greater cardiac motion.

Results

DB-STIR EPI was successfully implemented and images acquired along with DB-STIR HASTE in all three volunteers as shown in Figure 1. Signal in liver, spleen, skeletal muscle, fat, and myocardium were similar and blood nulling was comparable in the two sequences. HASTE showed greater sensitivity to trigger delay as shown in Figure 2. Regions of myocardium totally disappeared in HASTE images but remained consistent and uniform in DB-STIR EPI when the trigger delay was reduced by 50 msec.

Table 1: Imaging sequence parameters.

Parameter	DB-STIR HASTE	DB-STIR EPI
TE (msec)	49	47
Temporal Resolution (msec)	173	65
FOV (mm)	300 × 400	300 × 400
Image Matrix (pixels)	108 × 192	116 × 192

Conclusion

DB-STIR EPI generated single-shot fat-suppressed images with similar contrast to DB-STIR HASTE, but with less sensitivity to cardiac motion. Additional studies are needed to investigate the sensitivity of this technique to myocardial edema.

References

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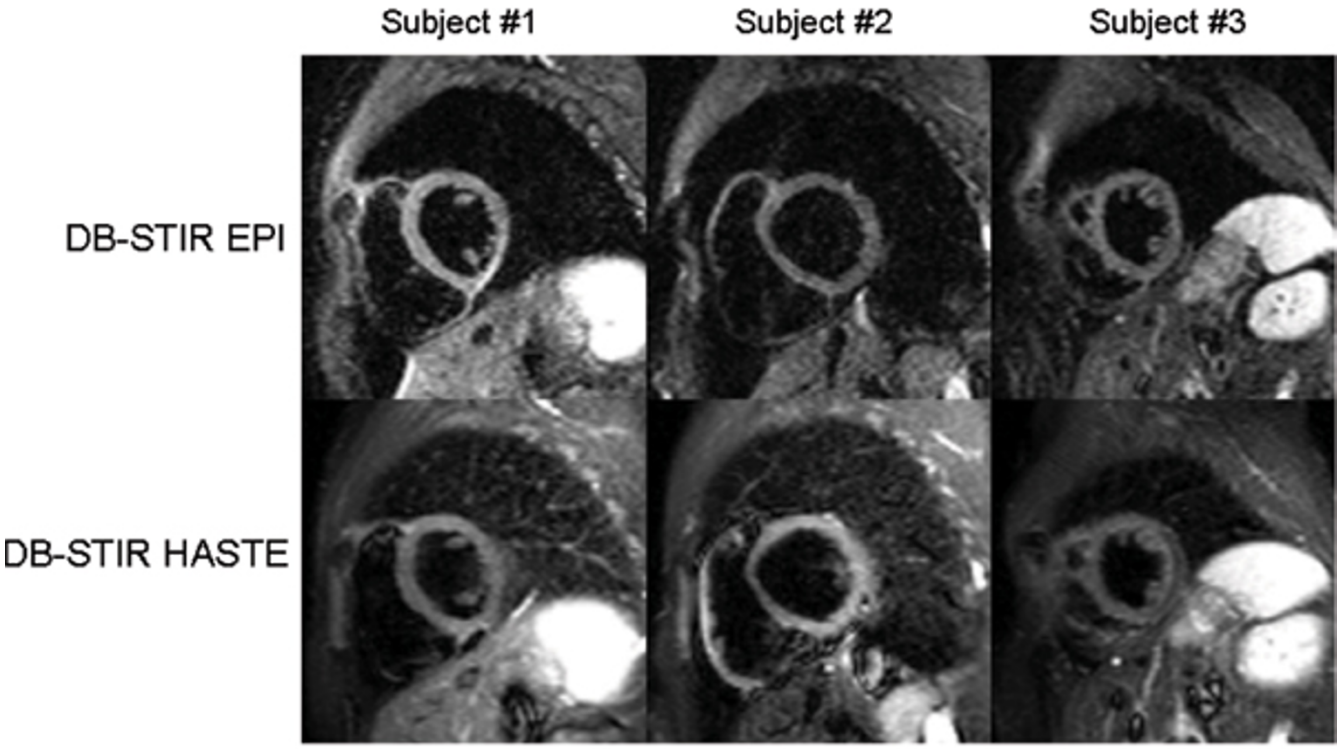

Figure 1: DB-STIR EPI (top row) and DB-STIR HASTE (bottom row) images acquired with trigger delay set to late diastole to achieve uniform myocardial signal in DB-STIR HASTE.

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DB-STIR EPI (top row) and DB-STIR HASTE (bottom row) images acquired with trigger delay set to late diastole to achieve uniform myocardial signal in DB-STIR-HASTE.

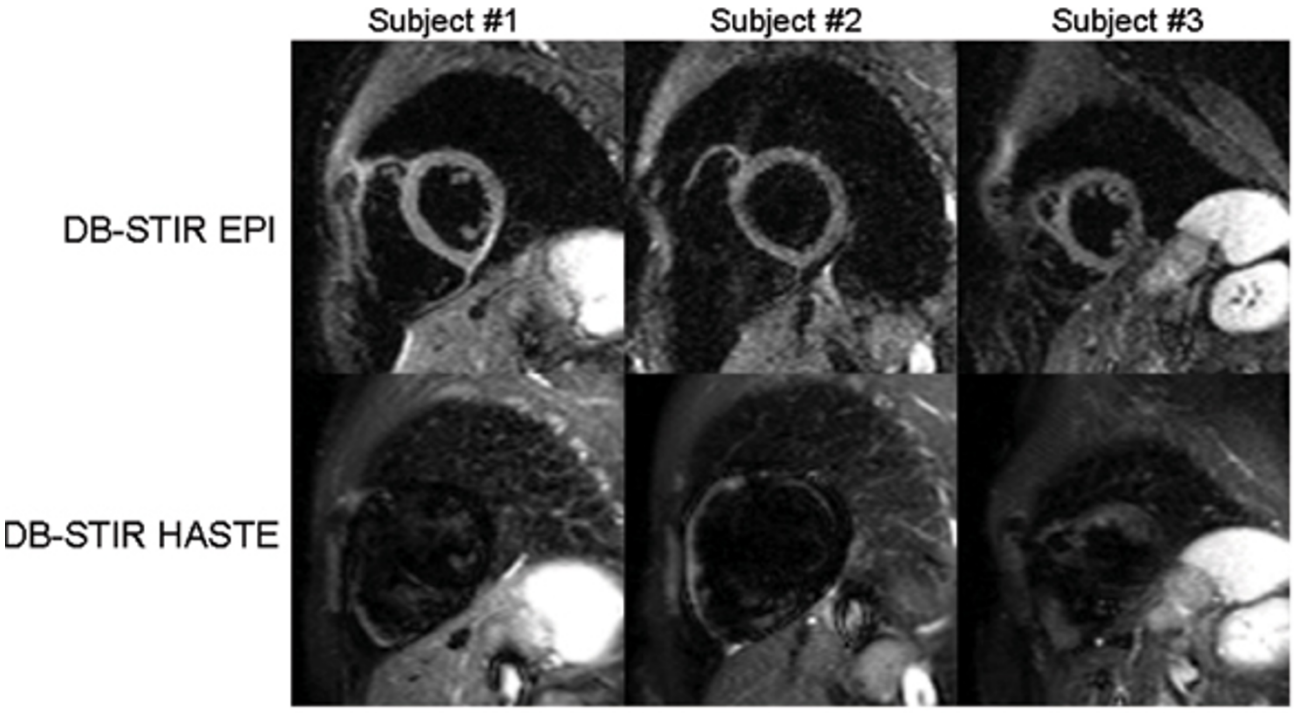

Figure 2: DB-STIR EPI (top row) and DB-STIR HASTE (bottom row) images acquired with trigger delay reduced by 50 msec to shift data acquisition earlier in diastole. Note insensitivity of DB-STIR EPI to change in trigger delay.

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DB-STIR EPI (top row) and DB-STIR HASTE (bottom row) images acquired with trigger delay reduced by 50 msec to shift data acquisition earlier in diastole. Note insensitivity of DB-STIR EPI to change in trigger delay.