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Meeting abstract

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1084 A double-inversion radial FSE and GRASE methods for the evaluation of cardiac masses

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Introduction

CMR can provide valuable information for the characterization of cardiac masses. Currently, however, the characterization of cardiac masses with CMR is based on the qualitative assessment of image contrast in T2-weighted, T1-weighted, or fat-suppressed images with or without the additional benefit of contrast media. Because the contrast in a CMR image is determined by MR-dependent tissue parameters, the quantitative measurement of these parameters should provide a more accurate approach for tissue characterization.

Recently we developed a radial double-inversion fast spin-echo (DIR-FSE) technique for the rapid evaluation of the T2 relaxation time (Altbach et al, Magn Reson Med 54:549, 2005; Echocardiography 24:316, 2007). High-resolution radial DIR-FSE data for T2 calculation are obtained in a breath hold making the technique attractive for routine clinical practice. The radial DIR gradient and spin-echo (GRASE) technique has also been proposed (Li et al, ISMRM 14:625, 2006). With the latter fat-water information is obtained in addition to T2.

Purpose

To demonstrate the utility of the radial DIR-FSE and DIR-GRASE techniques for characterizing cardiac masses.

Methods

The radial DIR-FSE and DIR-GRASE methods were implemented on a 1.5 T GE MRI scanner. Figures 1a–b show schematic diagrams of the methods. Radial DIR-FSE data were acquired with ETL = 16, 256 views, 256 readout points, BW = ± 32 kHz, TR = 1-2RR, NEX = 1. Radial DIR-GRASE data were acquired with ETL = 8, TR = 1RR, 192 views/echo, 256 readout points, BW = ± 64 kHz, NEX = 1. With these parameters data are acquired in one breath-hold per slice.

Radial DIR-FSE data are processed as follows. A high-resolution anatomical image is reconstructed from the full radial k-space data set. High-resolution images at various TE_{eff} are generated from the same k-space data set by using data corresponding to a specific TE in the central part of k-space, up to the Nyquist radius (Fig. 1c). Radial data acquired at $TE \neq TE_{eff}$ are incorporated in a progressive manner from the Nyquist point to the outer part of k-space. T2 maps were generated from the TE_{eff} images.

The TE_{eff} images from DIR-GRASE data are obtained (as shown in Fig. 1c) using only the echoes closer to the SE period (E_0). In order to obtain lipid-water information each of the four echoes in the GRASE sequence (E_{1-4}) are used to reconstruct four images with different phase shifts between fat and water. An iterative algorithm is used to obtain a lipid and a water image without the effects of field inhomogeneities (Reeder et al, Magn Reson Med 51:35, 2004).

Results

The anatomical images and T2 maps of four different cardiac masses obtained with radial DIR-FSE are shown in Fig. 2. Note that the T2 values for these masses are distinct. Data from a patient, referred to our study after being diagnosed with a malignant cardiac mass, are shown in Fig. 3.

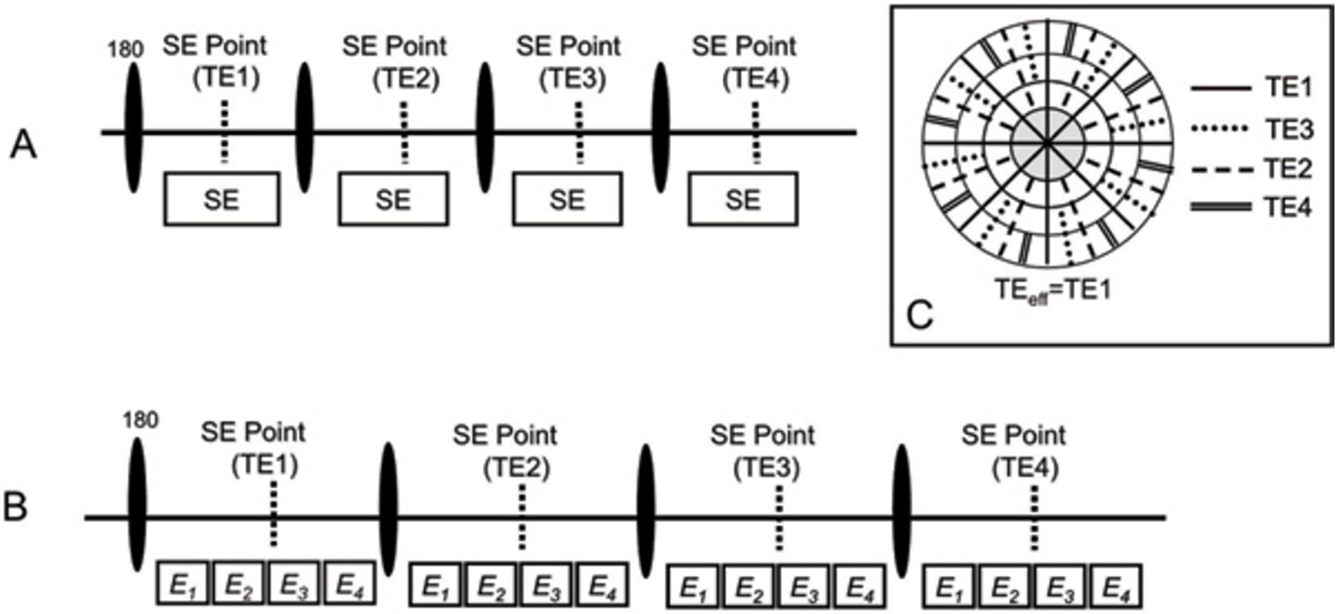

Figure 1
Schematic diagrams for radial (A) FSE and (B) GRASE (for clarity only the echo collection period is shown). (C) Generation of TE$_{elf}$ (demonstrated here for TE1).

In this case data were acquired with the radial DIR-GRASE method. The T2 of this mass is similar to the T2 of adipose tissue in the chest and the fat and water images clearly show that the mass is heavily lipid laden. These characteristics are not consistent with a malignant mass. They are consistent with the diagnosis of lipomatous hypertrophy of the inter-atrial septum (LHIAS).

Conclusion

We showed that radial FSE or GRASE methods can be used for the quantitative evaluation of cardiac masses. Data for

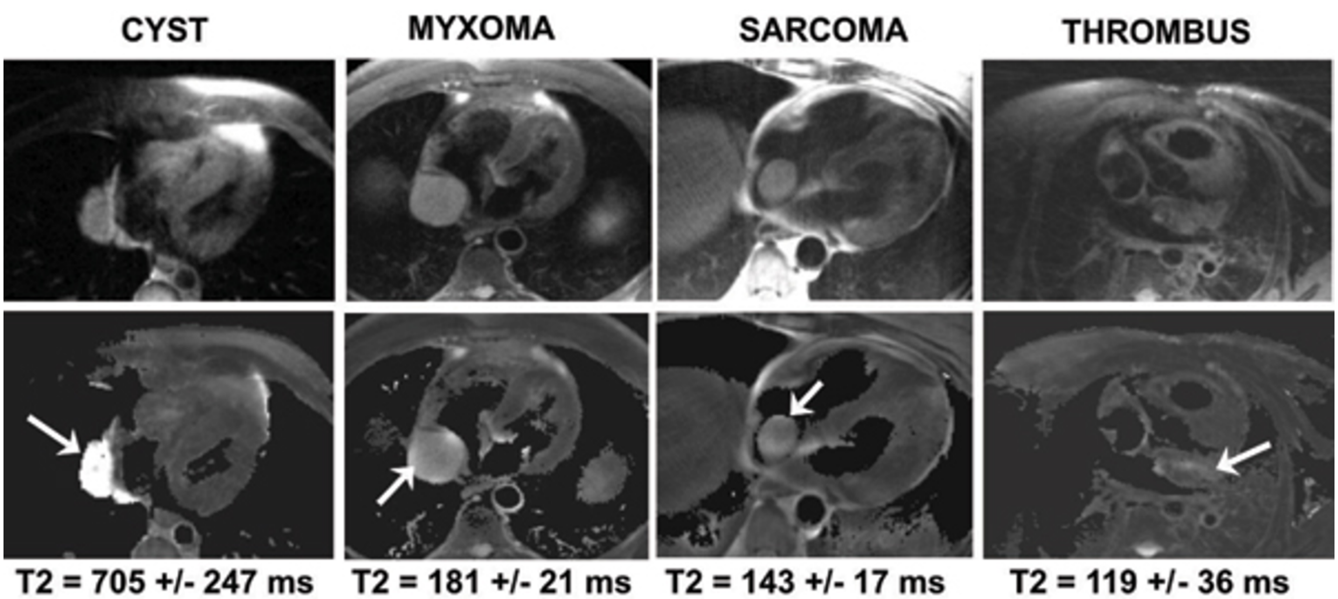

Figure 2
(Top) Anatomical images and (bottom) T2 maps of various cardiac masses obtained from radial DIR-FSE data.

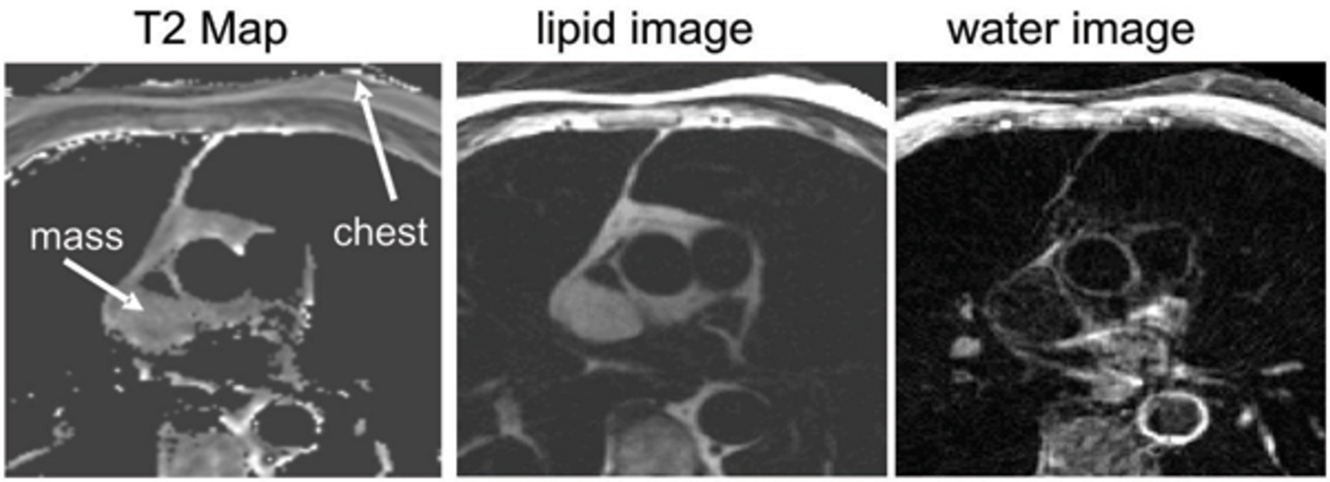

Figure 3
T2 map, lipid and water images obtained from radial DIR-GRASE data. The T2 of the mass (103 ± 13 ms) is similar to the T2 of adipose tissue in the chest (106 ± 11 ms). This is consistent with a lipid-laden mass as indicated in the lipid and water images.

T2 and lipid-water information are obtained in a breath hold thus providing a faster and efficient approach for characterizing these pathologies. In this study we only used T2 and lipid-water information for mass characterization. Radial GRASE data can be processed to estimate T2*, in addition to T2 and lipid-water information, thus providing an additional parameter for tissue characterization.

Acknowledgements
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