Journal of Cardiovascular Magnetic Resonance

Meeting abstract

1025 Multi-echo dixon fat and water separation method for detecting fibro-fatty infiltration in the myocardium

Peter Kellman*[1], Diego Hernando[2], Saurabh Shah[3], Sven Zuehlsdorff[3], Renate Jerecic[3], Zhi-Pei Liang[2] and Andrew E Arai[1]

Address: [1]NIH, Bethesda, USA, [2]University of Illinois, Urbana, IL, USA and [3]Siemens Medical Solutions, Chicago, IL, USA
* Corresponding author

from 11th Annual SCMR Scientific Sessions
Los Angeles, CA, USA. 1–3 February 2008

Published: 22 October 2008

Journal of Cardiovascular Magnetic Resonance 2008, **10**(Suppl 1):A150 doi:10.1186/1532-429X-10-S1-A150

This abstract is available from: http://jcmr-online.com/content/10/S1/A150

Introduction

The ability of MRI to discriminate between water and fat is important in tissue characterization. Conventional approaches to fat and water discrimination based on fat suppression are commonly used to characterize masses, however, have reduced ability to characterize fatty infiltration due to the poor contrast of microscopic fat and partial volume effects. Multi-echo Dixon methods [1,2] for fat and water separation provide a sensitive means of detecting small concentrations of fat with improved contrast. These methods are applied to the detection of fibro-fatty infiltration observed in chronic MI [3] as well cases of suspected ARVC/D [4]. In the present study, fat and water separation has been implemented both pre-contrast as well as applied to late enhancement using a multi-echo PSIR-GRE sequence.

Purpose

To develop a cardiac specific multi-echo fat and water separation method that is usable either pre- or post-contrast administration.

Methods

A multi-echo GRE sequence was implemented with fat and water separation using a multi-point Dixon reconstruction method. Late enhancement imaging used a multi-echo IR-GRE which additionally incorporated phase sensitive reconstruction [5]. The PSIR-GRE sequence acquires a proton density reference on alternate heartbeats which was used to jointly estimate a fieldmap and fat and water separation matrix that is applied to the inversion-recovery (IR) images. The VARPRO method [2] was used to robustly estimate the fieldmap in the presence of field inhomogeneity. The imaging sequence was ECG triggered, with 2 R-R intervals between inversions, and used an echo-train readout with 3 echoes with flyback for monopolar readout. The echo-train readout was used to increase the acquisition efficiency and thereby maintain acceptable breath-hold duration; optimum TE's [6] were not achievable using monopolar readout. Bipolar readout is being evaluated for TE optimization. Typical parameters for imaging with the Siemens ESPREE 1.5 T scanner were: bandwidth = 977 Hz/pixel, TE = 1.8, 4.6, 7.4 ms, TR = 9.5 ms, flip angle = 20–25°, image matrix = 256 × 126, views-per-segment = 21, breath-hold duration = 14 heartbeats including 2 discarded.

Results

Multiecho GRE fat-water imaging was performed on 26 patients, 12 of which had MI (2 acute/10 chronic). One patient had a large lipoma (Fig. 1) and another had a region with lipotamous hypertrophy of the interatrial septum. There were 3 cases with intra-myocardial fatty infiltration. A case with fatty infiltration in chronic MI is shown in Fig. 2 using water and fat separated PSIR, and a case with chronic MI without fatty infiltration is shown in Fig 3. Epicardial fat is readily distinguished from myocardium in all cases.

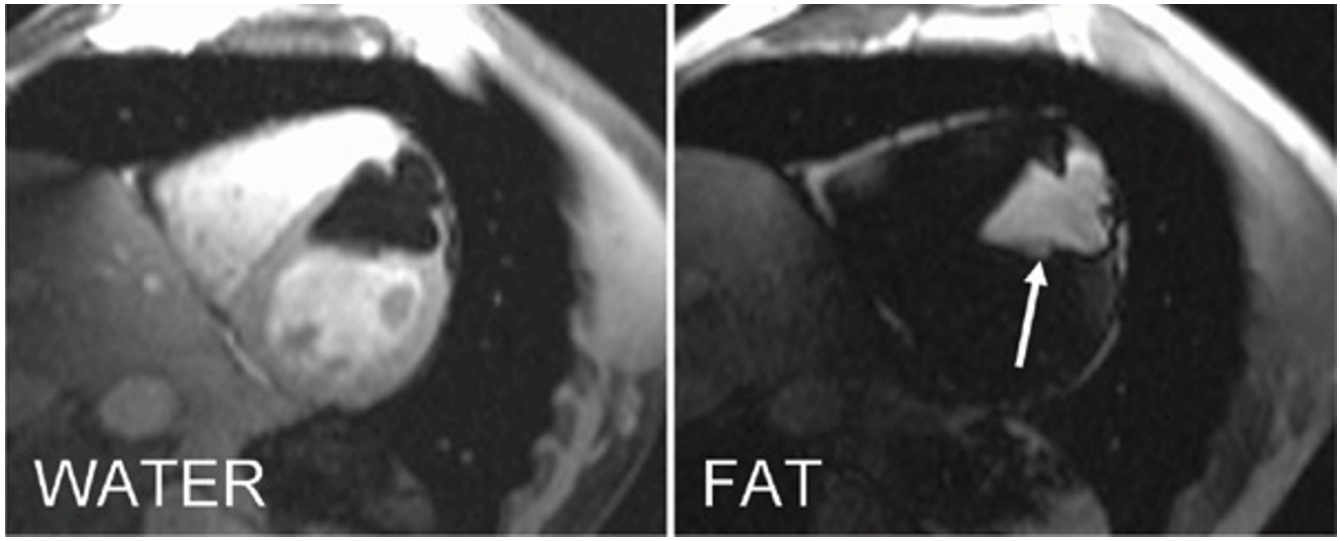

Figure 1
Water and fat separated pre-contrast images for patient with large anteroseptal lipoma.

A Multi-echo Dixon fat and water separation method for detecting fibro-fatty infiltration in the myocardium can be used before or after contrast administration. The method is easy to use and provides improved contrast compared with conventional fat suppression.

Discussion/Conclusion

The proposed approach can characterize myocardial fibro-fatty infiltration as demonstrated with late enhancement imaging. The method can also separate fat and water pre-contrast as illustrated by the case of lipoma. Initial experience indicates a much higher contrast and sensitivity than conventional fat suppression, or T1 measurement methods. The phase sensitive reconstruction is insensitive to inversion time (TI) which is particularly important when assessing diffuse fibrosis with a patchy appearance. The proposed method has the additional benefit of using a single breath-hold to produce fat and water images, thereby improving the workflow and ensuring spatial registration. The VARPRO method provided robust fieldmap estimates.

References

1. Reeder SB, *et al.*: *MRM* 2005, **54(3):**636-44.
2. Hernando D, *et al.*: *MRM* in press.

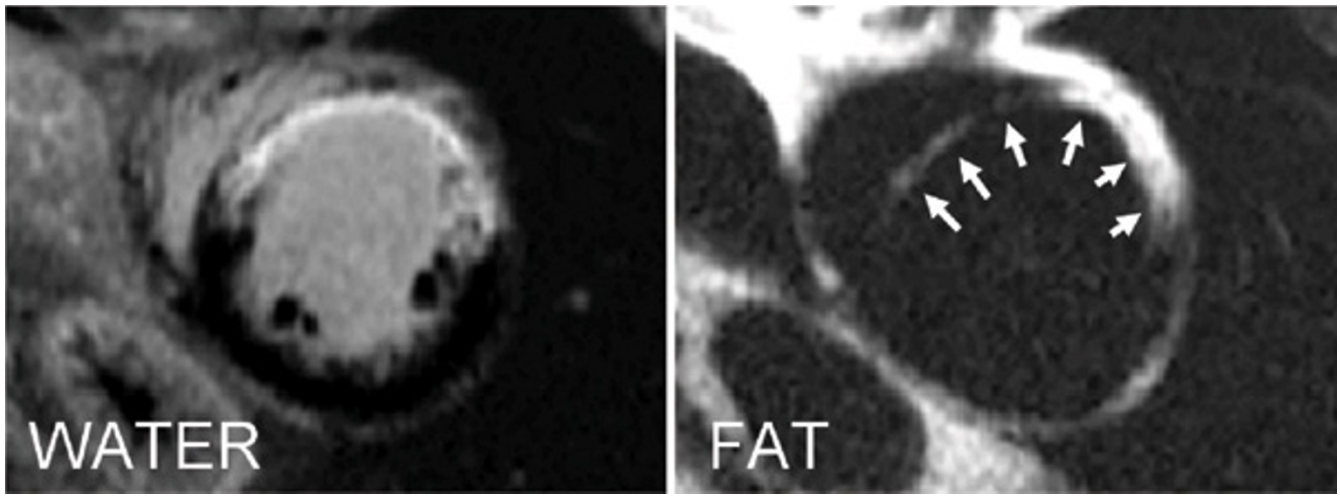

Figure 2
Water and fat separated PSIR late enhancement images for patient with chronic MI showing fatty infiltration.

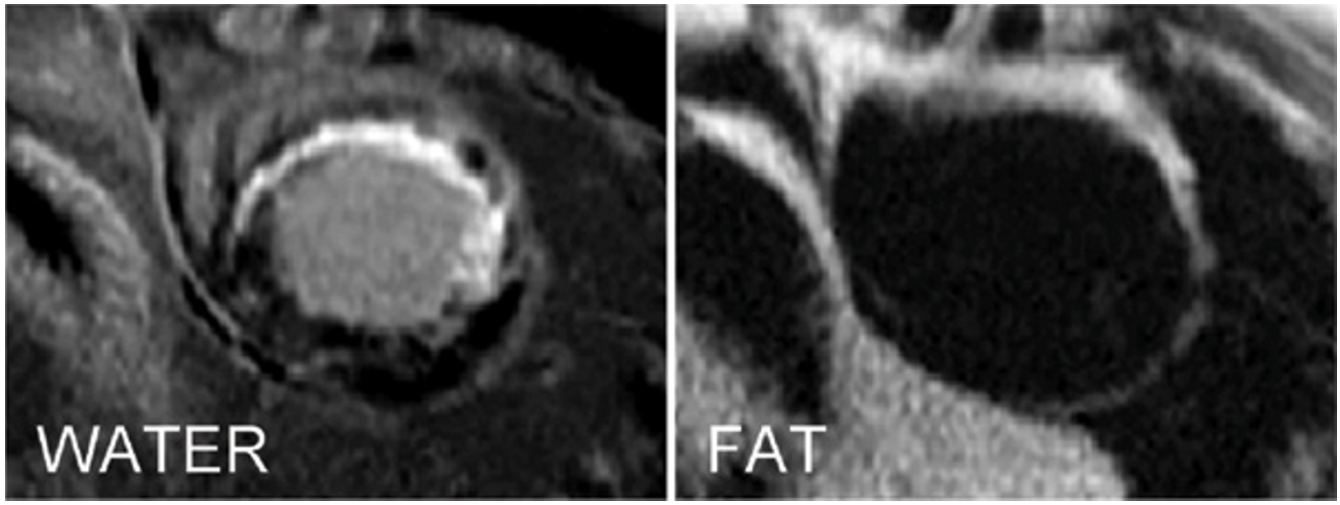

Figure 3
Water and fat separated PSIR late enhancement images for another patient with chronic MI without fatty infiltration.

3. Golfarb JW, *et al.*: *MRM* 2007, **57(5):**828-34.
4. Bluemke DA, *et al.*: *Cardiology* 2003, **99(3):**153-62.
5. Kellman P, *et al.*: *MRM* 2002, **47(2):**372-83.
6. Pineda AR, *et al.*: *MRM* 2005, **54(3):**625-35.