Ginami et al. Journal of Cardiovascular Magnetic Resonance 2016, 18(Suppl 1):O106
http://www.jcmr-online.com/content/18/S1/O106

Journal of Cardiovascular Magnetic Resonance

ORAL PRESENTATION Open Access

Whole heart free breathing phase sensitive inversion recovery MRI integrated with iterative self navigation for 100% scan efficiency; a first patient study

Giulia Ginami[1*], Davide Piccini[2,3], Simone Coppo[1], Tobias Rutz[4], Gabriele Bonanno[1], Gabriella Vincenti[4], Juerg Schwitter[4], Matthias Stuber[1,5]

From 19th Annual SCMR Scientific Sessions
Los Angeles, CA, USA. 27-30 January 2016

Background

Phase Sensitive Inversion Recovery (PSIR) [1] allows for the visualization of myocardial scars using late gadolinium enhancement (LGE), ensuring robustness with respect to sequence timing. 3D whole-heart PSIR has been integrated with diaphragmatic navigator-gating (NAV) [2] to compensate for respiratory motion. However, both NAV and the need for two different datasets to be acquired (IR and reference) lead to a prohibitively long scanning time. Thus, integrating 1D respiratory Self-Navigation (SN) [3] with 3D-PSIR to obtain 100% scan efficiency is desirable. Unfortunately, signal and contrast variations between the IR and the reference dataset pose a major challenge. Here, we hypothesized that a recently introduced contrast independent iterative approach to 1D SN (IT-SN) [4] effectively suppresses respiratory motion in 3D-PSIR acquisitions.

Methods

Data acquisition was first performed in a cohort of 8 patients to ascertain the successful integration of IT-SN with 3D whole-heart PSIR, after a regular 2D PSIR LGE examination. In a second cohort (7 patients), data were acquired using a similar protocol after slow infusion (0.2 mmol/kg, Gadobutrol) yet without preceding 2D PSIR LGE. In both cases, a prototype 3D radial SN bSSFP [5] was used on a 1.5T MRI scanner (Magnetom Aera, Siemens). Imaging parameters were: TR/TE 2.9/1.45 ms, FOV 220 mm^3, resolution 1.4 mm^3, RF excitation angle 115°(IR) and 8°(reference), Bandwidth 140 Hz/Px, fat saturation, TI 250-320 ms. IT-SN was used for respiratory motion correction. For the first cohort, uncorrected PSIR datasets were compared with PSIR datasets corrected with IT-SN, by computing endocardial border sharpness (EBS), sharpness of visible scars (%SS) [6], and by visual grading provided by two experts (grades ranging from 4, fully diagnostic, to 0, non-diagnostic). For the second cohort, IT-SN corrected PSIR images were compared with IT-SN corrected IR images to evaluate the efficacy of myocardial signal suppression. SNR of blood and myocardium were computed together with CNR between blood and myocardium.

Results

For the first patient cohort, IT-SN improved image quality with respect to the uncorrected datasets (Fig 1), in terms of EBS (0.32 ± 0.14 mm^{-1} and 0.24 ± 1.30 mm^{-1}, $p < 0.05$), %SS (14.0 ± 5.4 and 10.7 ± 7.4, $p < 0.005$), and visual grading (3.3 ± 0.8 and 2.7 ± 1.0, $p < 0.05$). In the second cohort, improved myocardial signal suppression was found when comparing IT-SN PSIR to IT-SN IR (Fig 2); SNR of the blood remained unchanged (%change 10.7 ± 28.0%, p = NS), SNR of the myocardium decreased (%change -31.5 ± 24.2, $p < 0.05$) and CNR improved (%change 64.3 ± 72.2, $p < 0.02$).

Conclusions

IT-SN allows for free-breathing motion suppressed 3D whole-heart PSIR imaging with 100% scan efficiency. When compared to IT-SN IR, myocardial signal is more

[1]Department of Radiology, University Hospital (CHUV) and University of Lausanne (UNIL), Lausanne, Switzerland
Full list of author information is available at the end of the article

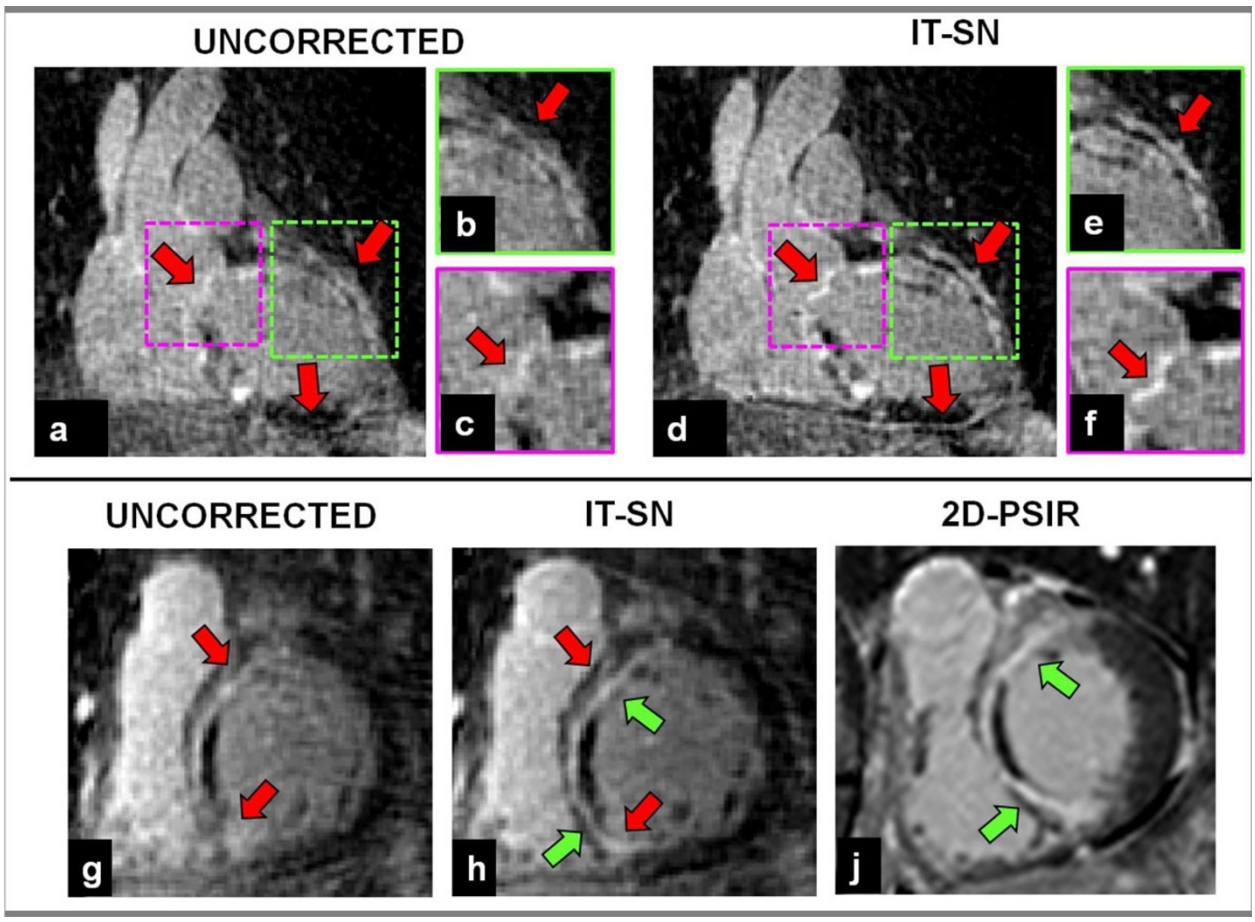

Figure 1 Myocardial scars visualization in a patient with anterior myocardial infarction. Sharp visualization of myocardial scars is obtained when IT-SN is applied (d) with respect to the uncorrected dataset (a), and as shown in the zoomed sections in b and e (red arrows). Furthermore, visualization of calcified structures, which are not detectable in the uncorrected dataset (c) become visible after the application of IT-SN (f). A comparison between uncorrected dataset (g) and IT-SN corrected dataset (h) is reported in short axis view; in this case, conventional 2D PSIR is also shown (j); again, image quality improves when IT-SN is applied (g and h, red arrows), and image quality of the 3D acquisition approaches that of the more conventional 2D PSIR method (h and j, green arrows).

effectively suppressed, providing an improved delineation of scar tissue. Studies in a larger patient cohort are now warranted. BIBLIOGRAPHY: 1 Kellmann 2002; 2 Ehman 1989; 3 Stehning 2005; 4 Ginami 2015; 5 Piccini 2012; 6 Etienne 2002.

doi:10.1186/1532-429X-18-S1-O106
Cite this article as: Ginami *et al.*: **Whole heart free breathing phase sensitive inversion recovery MRI integrated with iterative self navigation for 100% scan efficiency; a first patient study.** *Journal of Cardiovascular Magnetic Resonance* 2016 **18**(Suppl 1):O106.

Authors' details
[1]Department of Radiology, University Hospital (CHUV) and University of Lausanne (UNIL), Lausanne, Switzerland. [2]Advanced Clinical Imaging Technology, Siemens Healthcare IM BM PI, Lausanne, Switzerland. [3]Department of Radiology, University Hospital (CHUV), Lausanne, Switzerland. [4]Division of Cardiology and Cardiac MR Center, University Hospital of Lausanne (CHUV), Lausanne, Switzerland. [5]Center for Biomedical Imaging (CIBM), Lausanne, Switzerland.

Published: 27 January 2016

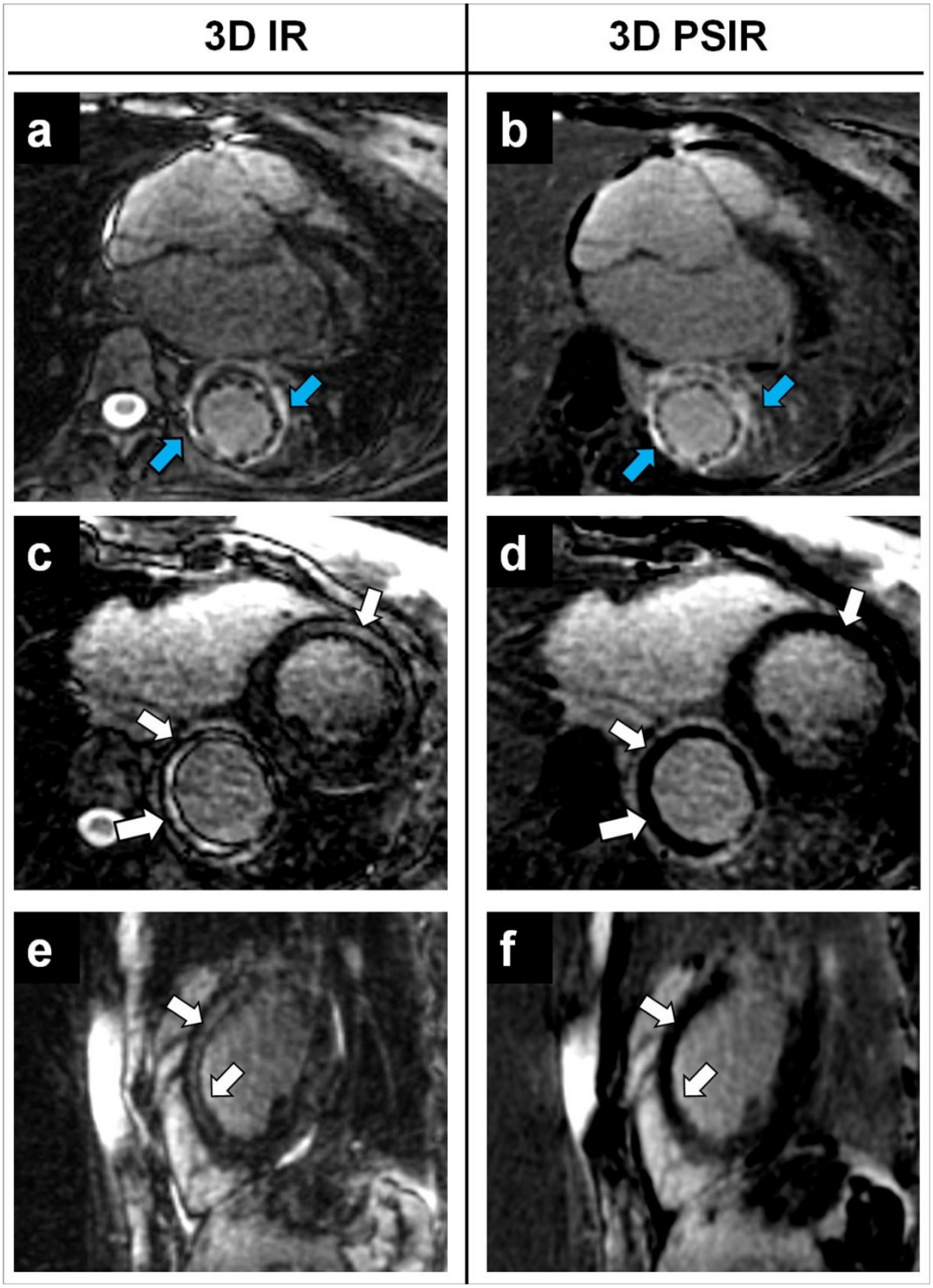

Figure 2 Comparison between 3D IT-SN IR (a, c, e) and 3D IT-SN PSIR (b, d, f) in one patient with LGE findings in the descending aorta (blue arrow in a, b); here, and as indicated by the white arrows in c-d and e-f, nulling of healthy myocardial signal improves with the use of 3D PSIR, whereas myocardium does not appear to be properly suppressed in the case of 3D IR.