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Poster presentation

CMR analysis of global and regional left ventricular function in a single breath-hold

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Introduction

Cardiac magnetic resonance (CMR) steady-state free precession (SSFP) images are the reference standard for measuring left ventricular function (LVF) using section summation of short axis images and for analysis of regional wall motion abnormalities (RWMA). Acceleration of this multiple (typically 10-15) breath-hold approach is desirable. Temporal Parallel Acquisition Technique (TPAT) acceleration allows for acquisition of a complete short axis stack in a single breath-hold with limited resolution.

Purpose

To evaluate global and regional LVF analysis of single breath-hold image stacks acquired with TPAT acceleration, compared with standard imaging.

Methods

111 patients (85 male, mean age 54.4 ± 16.7) undergoing CMR for various indications were enrolled. CMR on a 1.5 T Magnetom Avanto (Siemens Medical Solutions, Germany) included iPAT (Integrated Parallel Acquisition Technique) accelerated SSFP cine imaging (TrueFISP, TR 3 ms, TE 1.5 ms, FA 72°, sl 6 mm, temporal resolution 45 ms, iPAT factor 2), inversion recovery (IR) delayed enhancement imaging using, and further sequences if required.

In a single breath-hold, short axis cines covering the LV were acquired using a TPAT accelerated SSFP sequence (TE 1.1 ms, TR 4.6 ms, FA 72°, sl 8 mm, temporal resolution 45 ms, TPAT factor 3).

For both short axis stacks, LVF was analyzed by blinded observers using section summation (Argus, Siemens Medical Solutions, Germany). RWMA were assessed using the 17 segment model.

Results

Despite longer breath-holding (28 ± 6 s), TPAT imaging was possible in 108 of 111 patients. LV volumes were marginally, but significantly lower with TPAT imaging,

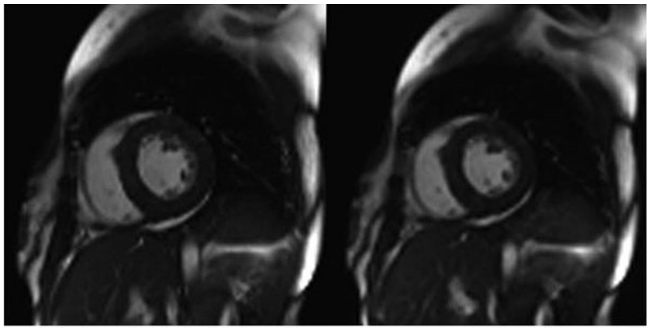

Figure 1
Mid-ventricular short axis scans acquired with standard single slice/multiple breath-hold (left) and TPAT single breath-hold imaging (right), the latter showing slightly reduced resolution.

Table 1: Volumetric results for standard and TPAT imaging (n = 108; mean ± standard deviation)

	Standard	TPAT	Mean difference	p	Pearsons correlation coefficient	Intraclass correlation coefficient
Enddiastolic volume	138.8 ± 39.7	137.3 ± 39.4	-1.6 ± 7.9	0.0466	0.9795	0.979
Endsystolic volume	59.5 ± 37.4	57.8 ± 36.6	-1.8 ± 6.0	0.0032	0.9864	0.986
Ejection fraction	59.3 ± 15.1	60.0 ± 15.1	0.7 ± 3.4	0.0274	0.9730	0.974
Myocardial mass	138.4 ± 37.0	136.6 ± 36.8	1.9 ± 8.2	0.0191	0.9751	0.974

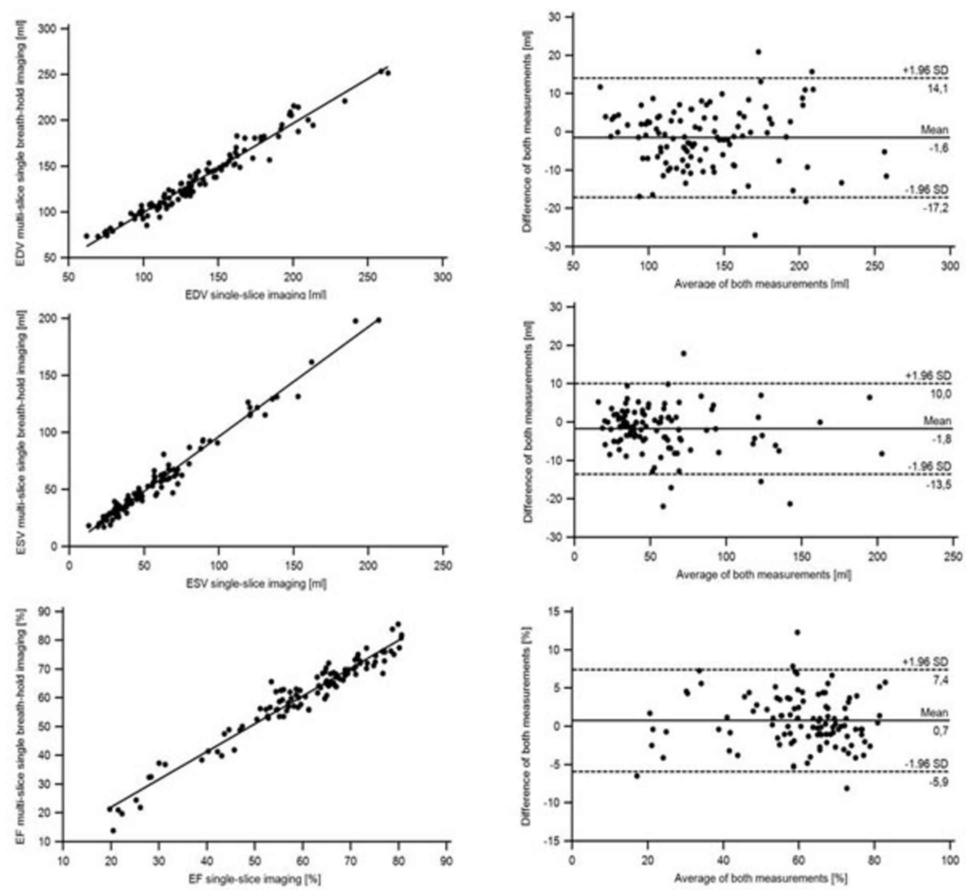

Figure 2
Correlation (left) and Bland-Altman analysis (right) of volumetric data from standard single slice/multiple breath-hold and TPAT single breath-hold imaging (EDV: enddiastolic volume, ESV: endsystolic volume, EF: ejection fraction.

Table 2: Number of AHA LV segments with wall motion abnormalities (n = 108)

	Normokinetic	Hypokinetic	Akinetic	Dyskinetic
Standard imaging	1492	167	56	11
TPAT accelerated imaging	1504	178	37	9

and LV ejection fraction was significantly higher compared to standard imaging (Table 1). Correlation and agreement in Bland-Altmann analysis were excellent (Figures 1 and 2).

RWMA were detected (Table 2) in the same 43 patients with both techniques. 234 (standard) and 225 segments (TPAT) were found abnormal (p = 0,065).

Discussion

Single breath-hold imaging using TPAT acceleration allows for LVF analysis in good agreement with the reference standard, although yielding marginally lower LV volumes and higher LVEF. Reducing costly image acquisition time and improving patient comfort, it may become the method of choice for LVF analysis. Improvement in resolution is desirable for RWMA analysis.