Journal of Cardiovascular Magnetic Resonance (2005) **7,** 537–538

ISSN: 1097-6647 print / 1532-429X online
DOI: 10.1081/JCMR-200053632

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Letter to the editor

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Dear Editor,

The assessment of left ventricular (LV) function plays a central role in cardiac imaging. While in principle all imaging modalities are able to estimate LV volumes and ejection fraction (EF), cardiac MRI is regarded as the gold standard because of its high reproducibility, which is of particular value in research trials targeting global LV function (1). The method of choice is the short-axis multi-slice cine technique, where the entire LV is sampled with eight to 14 slices (2).

In their study published in issue 3/2004 of the Journal of Cardiovascular Magnetic Resonance, Sievers et al. measure LV function in nine healthy volunteers and in 10 patients with cardiac failure (five with dilated cardiomyopathy, five with ischemic heart disease) by short-axis multi-slice, long-axis biplane, and long-axis single-plane cine MRI. They conclude that not only biplane but also single-plane assessment is "a reasonable and rapid alternative to the conventional short-axis approach for LV volume and EF assessment in patients with heart failure and impaired ventricular function" (3). This is contradictory to the commonly held belief that LV impairment, particularly in patients with coronary artery disease, is rarely evenly distributed over the entire LV. Monoplane techniques, which by definition cannot cover all three coronary artery territories, use mathematical assumptions to calculate the 3D shape of the LV from 2D areas of a single view. Hence, they are prone to either overestimate global LV function by missing regional wall motion abnormalities, or to underestimate LV function by extrapolating a regional wall motion abnormality to the entire LV.

In fact, the methods used and the results given in the article do not justify the conclusions drawn by the authors. Instead of measurements of agreement between the short-axis, biplane, and single-plane techniques, only Wilcoxon signed-rank tests were performed. Results of the different techniques are only given as total mean ± standard deviation, and no plots of the results are shown. The generally accepted way to compare two similar measurement techniques is the method described by Bland and Altman (4).

To emphasize our opinion that single-plane measurements are not suitable for the measurement of global LV function, Table 1 and Fig. 1 give the results of a retrospective analysis of LV EF using long-axis and multi-slice short-axis techniques in a series of 18 patients (15 male, age mean ± standard deviation 56 ± 11 years) with chronic myocardial infarction and in 15 healthy control subjects (eight male, age 31 ± 12 years) from our institution (all images were acquired as part of an institutionally approved research study on a 1.5-T Philips Gyroscan Intera system with breath-hold steady-state free precession pulse sequences; long axis: TR 3.0 ms, TE 1.5 ms, FA 55°, slice thickness 7 mm, short axis: TR 3.52 ms, TE 1.76 ms, FA 55°, slice thickness 10 mm, no gap; image analysis was performed using Mass 5.0, Medis, Leiden, The Netherlands; Bland-Altman plots were generated with Analyze-it, Analyze-it Software Ltd., Leeds, UK). Our data demonstrate that the agreement between the standard multi-slice short-axis technique and the single-plane approaches is reasonable in subjects with normal LV function (with differences of $\leq$ 4% EF), but deteriorates in patients with impaired regional and global LV function (maximum difference 11% EF). Biplane assessment was superior to any of the single-plane methods (maximum difference 4% of EF).

In conclusion, we do not agree that single-plane measurements of LV function are a suitable alternative to multi-plane techniques, regardless of the pulse sequence used. The status of cardiac MRI as a highly reproducible reference standard

Table 1. Ejection fraction (%) in patients with chronic myocardial infarction and in healthy volunteers

	Patients (n = 18)		Volunteers (n = 15)	
	Mean ± SD	Range	Mean ± SD	Range
SA	48.4 ± 10.4	30–65	60.3 ± 3.1	55–65
VLA	48.1 ± 12.9	22–67	60.3 ± 2.6	55–65
4-CV	49.6 ± 9.5	36–65	61.7 ± 3.5	55–67
Biplane	48.8 ± 10.7	30–66	61.0 ± 2.9	56–66

Note: SA = multi-slice short-axis technique; VLA = vertical long axis; 4-CV = four-chamber view; biplane = average of VLA and 4-CV; SD = standard deviation.

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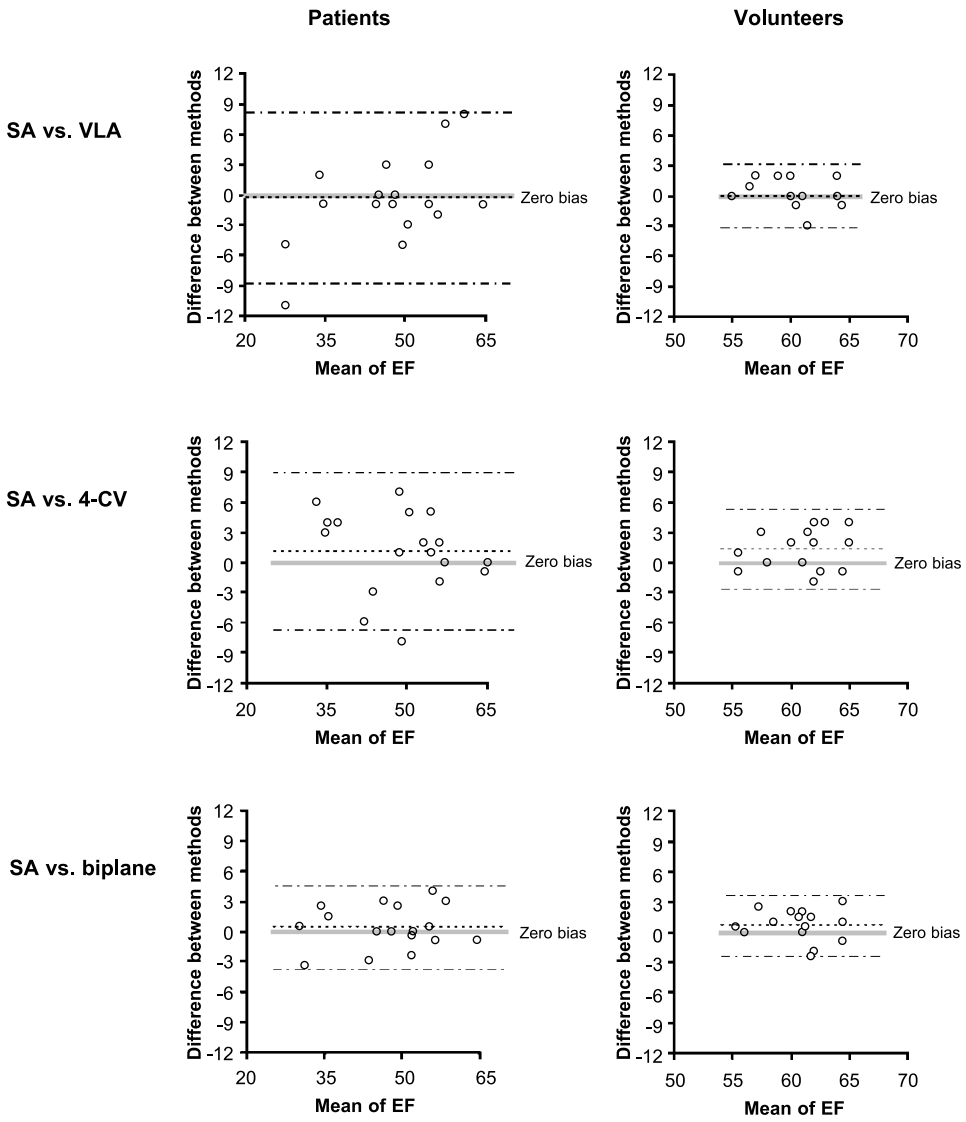

Figure 1. Bland-Altman analysis of agreement between short-axis (SA) multi-plane, vertical long-axis (VLA) single-plane, four-chamber view (4-CV) single-plane, and biplane methods for the assessment of left-ventricular ejection fraction (%). Dotted line = bias of long-axis method compared with short-axis method; dashed lines = 95% limits of agreement.

for the assessment of global LV function is based on its flexible multi-plane capabilities.

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