

Poster presentation

A new semi-automated algorithm for determining LV volumes is especially valuable for inexperienced users

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Introduction

Cardiac MRI (CMR) is often considered the reference standard for quantifying left ventricular (LV) volumes and ejection fraction (EF). Although images have high spatial and contrast resolution, quantitative analysis is often performed using relatively low-resolution endocardial contours. Determining the correct position of the endocardial boundary and identifying the most basal short-axis slice can be subjective. This is especially problematic for less experienced users and is an increasingly important issue as CMR utilization increases and is performed at a growing number of imaging centers.

Purpose

To assess a new, semi-automated algorithm for determining LV volumes and ejection fraction.

Methods

Ten normal CMR studies were analyzed by two CMR users with more than 10 years experience ("Experts") and by three novice users (two high school students and a college student) with no prior experience. Novices had 1-2 hours of training that included cardiac anatomy, segmentation tips, and instructions on how to use the software. End-diastolic and end-systolic endocardial and epicardial contours were drawn manually and were determined using a new, semi-automated algorithm (ReportCard 4.0). The endocardial contour determined by the algorithm excludes papillary muscles and trabeculations from the LV cavity. Furthermore, the algorithm requires the user to

define the basal and apical extent of the LV from a long axis view. For statistical analysis, one of the two experts was considered the reference standard.

Results

Figure 1 shows that for manual ejection fraction (EF) quantification, there is poor interobserver agreement between the Novices and the reference standard ($r^2 = 0.11$), but agreement improves markedly with the semiautomatic algorithm ($r^2 = 0.90$). Bland-Altman analysis shows better agreement is obtained for LV volumes and EF both for the Novices and the Expert. (Table 1). Average Novice analysis time with the semi-automated method was 8 + 3 min vs. 12 + 4 min manually ($p < 0.01$). As an additional confirmation that the semi-automated algorithm provides more accurate quantification, LV stroke volume was compared to pulmonary artery flow as determined from phase-contrast images. With the semi-automated algorithm, the r^2 increased from 0.77 to 0.96.

Conclusion

Semi-automated LV quantification is more accurate and has less interobserver variation than manual tracing. The algorithm substantially improves the analysis of inexperienced users, enabling them to obtain results similar to experts with a ~30% reduction in analysis time.

Table 1:

	Novices			Expert		
	EDV (ml)	ESV (ml)	EF (%)	EDV (ml)	ESV (ml)	EF (%)
Manual	-4 ± 9	-7 ± 12	4 ± 9	-6 ± 7	5 ± 5	2 ± 3
Semi-Auto	1 ± 4	0 ± 3	0 ± 2	2 ± 3	0 ± 2	1 ± 2

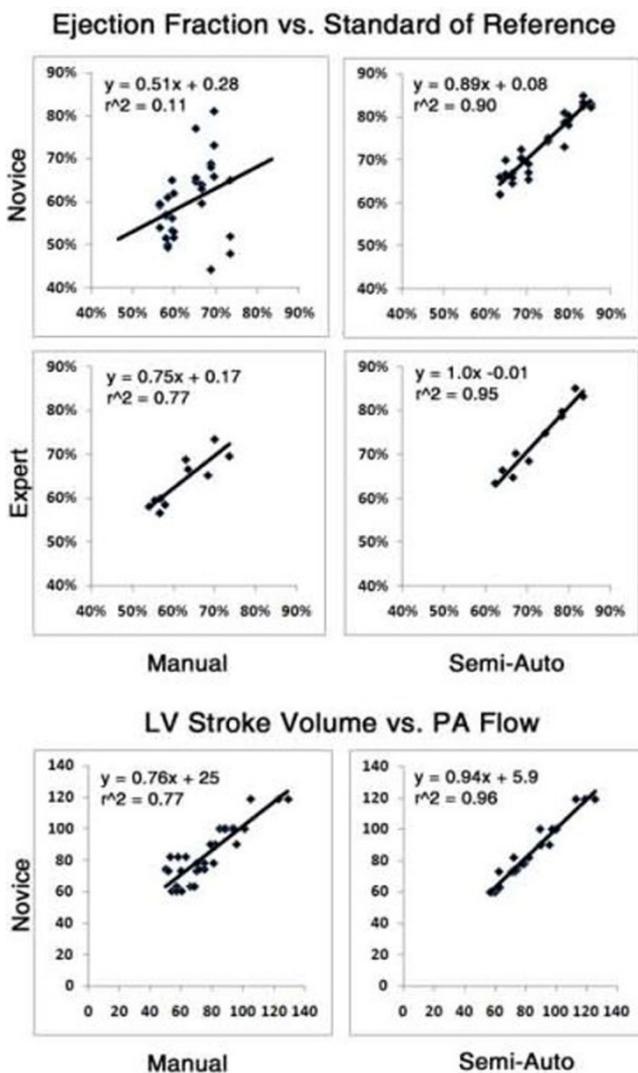


Figure 1

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