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Meeting abstract

1114 The number of short-axis series for MR left ventricular analysis can be reduced when a combined long-axis and short-axis analysis strategy is used

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Introduction

Cardiovascular magnetic resonance (CMR) is considered the gold standard technique for the measurement of left ventricular (LV) volumes and function which are very important parameters in the cardiac disease diagnosis, prognosis and in the cardiac patient's follow up. The quantitative analysis of the LV function is usually done on a stack of short axis slices of the ventricle, covering the entire left ventricle from base to apex. Modern MR techniques with fast imaging permit to acquire the whole stack of images, on a short axis view, in 5–10 minutes. Despite that CMR is considered a time consuming technique in the LV functional assessment due to the additional long post-processing analysis.

Purpose

To investigate the value of a shortened acquisition and analysis strategy for quantitative analysis of left ventricular function in cardiac magnetic resonance imaging.

Methods and materials

Cine MRI was performed using a steady-state free-precession technique (FIESTA). Left ventricular parameters of 32 patients were measured with two strategies. First a combination of all short-axis series (8 mm thickness, 2 mm gap) covering the heart from base to apex and two standard long-axis series was used (All). Second only 3 short axis series (1 basal, 1 mid and 1 apical) were combined with the two long axis series (3 slice). For both strategies end-diastolic (ED) volume, end-systolic (ES) volume and ejection fraction (EF) were calculated using commercial available software (CAAS-MRV, PieMedical, Maastricht, The Netherlands). For the calculation of LV ED and ES volumes in the All slice strategy the Simpson's rule was used. For the 3 slice strategy missing slices were interpolate and basal and apical delineations were based on the long axis views. For comparison to other faster strategies ED volume, ES volume and EF were also calculated using the monoplane ellipsoid formula and the biplane ellipsoid formula.

Results

All LV values were expressed as mean ± standard deviation (SD) and as mean differences for each compared to the All slice strategy in Table 1. The 3 slice strategy showed good correlation with the All slice strategy (R^2 = 0.82 to 0.99). ED, ES and EF values of the 3 slice strategy were comparable to the values obtained by the All slice strategy ($p < 0,05$). Acquisition times (mean ± SD) were 4 min 59 s ± 21 s for the All slice strategy and 1 min 5 s ± 10 s for the 3 slice strategy. The times of analysis (mean ± SD) were 10 min ± 24 s in the All slice strategy and 5 min 15 s ± 20 s in the 3 slice strategy. Both monoplane and biplane ellipsoid techniques showed good correlation with the All slice

Table 1: LV parameters: mean ± SD and mean differences for each strategy compared to the All slice strategy.

Parameter	*All slice strategy Mean ± SD*	*3 slice strategy Mean ± SD*	*All slice strategy-3 slice strategy Mean differences ± SD*	*Monoplane ellipsoid model Mean ± SD*	*All slice strategy-monoplane ellipsoid model Mean differences ± SD*	*Biplane ellipsoid model Mean ± SD*	*All slice strategy-biplane ellipsoid model Mean differences ± SD*
ED volume (ml)	223,7 ± 114,9	219,9 ± 114,7	3,7 ± 12,4	203,8 ± 125,1	19,9 ± 38,3	191,4 ± 96,4	32,3 ± 28,2
ES volume (ml)	139,4 ± 123,0	137,6 ± 126,6	1,8 ± 12,6	106,7 ± 125,0	32,7 ± 23,5	107,0 ± 89,3	32,4 ± 44,7
EF (%)	44,3 ± 17,0	44,5 ± 17,8	-0,2 ± 4,9	57,0 ± 22,5	-12,6 ± 10,2	48,9 ± 18,0	-4,5 ± 8,5

strategy (R^2 = 0.82 to 0.96) but ED and ES volumes obtained with these startegies were significant underestimated ($p < 0,05$) and variability increased compared to the All slice strategy; EF values were overestimated ($p < 0,05$). For both techniques, compared to the All slice strategy, the bigger differences were seen in patients with larger cardiac volumes.

Conclusion

Quantitative left ventricular analysis by MRI can reliably be achieved with a combined analysis of 3 short axis and 2 long axis series maintaining of high temporal and spatial resolution but decreasing both acquisition and analysis times. Other strategies showed large variability.