

POSTER PRESENTATION

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CMR validation of fractional changes in annulo-apical angles and TAPSE for rapid assessment of right ventricular systolic function

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Background

Volumetric assessment of the right ventricle (RV) by Cardiac Magnetic Resonance (CMR), albeit time-consuming, provides accurate and reproducible measurement of RV ejection fraction (RVEF). Tricuspid annulus peak systolic excursion (TAPSE) is a predominantly Echo-validated rapidly-derived surrogate of RV function. Correlations between RVEF and systolic changes in annulo-apical angles (AAAs) have not previously been evaluated.

Objective

To assess the use of changes in AAAs and TAPSE as rapidly-derived surrogate markers of RV systolic function using CMR.

Methods

We measured RV volumes from short-axis bSSFP stacks in patients undergoing clinically indicated CMR scans. RVEF was calculated from volumes derived by semi-automated endocardial contouring (QMass[®] MR 7.2). AAAs (α, β, θ angles -see figure 1), subtended by a triangle connecting the medial and lateral extent of the tricuspid valve annulus and RV apex, and fractional changes in AAAs ($\Delta AAA/EDAAA \times 100$, whereby $\Delta AAA = EDAAA - ESAAA$) were measured from end-diastolic (ED) and end-systolic (ES) 4chamber SSFP cine still frames. TAPSE was measured as the change in length of a line connecting the lateral tricuspid valve annulus with the RV apex from ED to ES. Parameters were compared with RVEF using Spearman rank

correlations; ROC curves constructed to assess accuracy of the parameters in predicting an RVEF < 50%.

Results

Forty subjects were included: 10 normals, 10 mildly-impaired, 10 moderately-impaired, and 10 with severely-impaired RV systolic function. Median (25th-75th percentile) RVEF for each subgroup was 53.5% (51.4%-55.7%), 41.5% (38.1%-47.2%), 30.0% (21.7%-33.5%), and 15.8% (9.6%-21.2%), respectively. Correlations with RVEF: TAPSE (0.74 $p < 0.001$), fractional changes of α angle (0.64, $p < 0.001$), β angle (-0.39, $p < 0.05$), and θ angle, which had the highest correlation (-0.77, $p < 0.001$). Smaller increases or a decrease in magnitude of the θ angle from ED to ES are associated with lower RVEFs, whereby a fractional θ angle change of $\geq -25.5\%$ predicts RVEF < 50% [97% sensitivity, 91% specificity, AUC=0.98]. The cut-off for TAPSE is ≤ 1.87 cm [100% sensitivity, 82% specificity, AUC=0.98]. Intra- and inter-observer reproducibility is excellent as shown by intra-class correlation coefficients for TAPSE (0.98 and 0.92, respectively) and fractional θ angle change (0.96 and 0.80, respectively).

Conclusions

Both fractional θ angle change and TAPSE strongly correlate with RVEF, and are accurate predictors of RVEF < 50%. These measurements provide an excellent alternative to the more time-consuming derivation of RVEF obtained volumetrically by endocardial chamber tracing.

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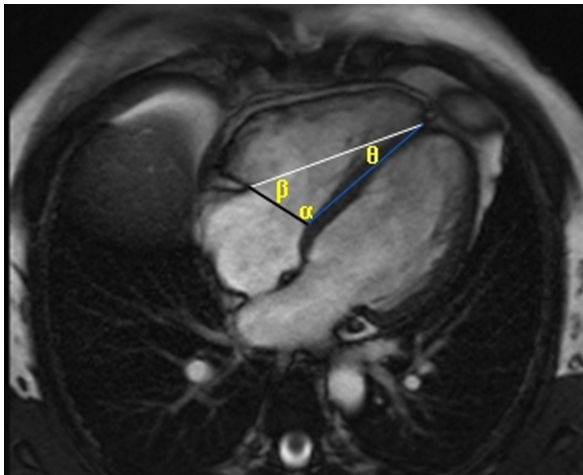
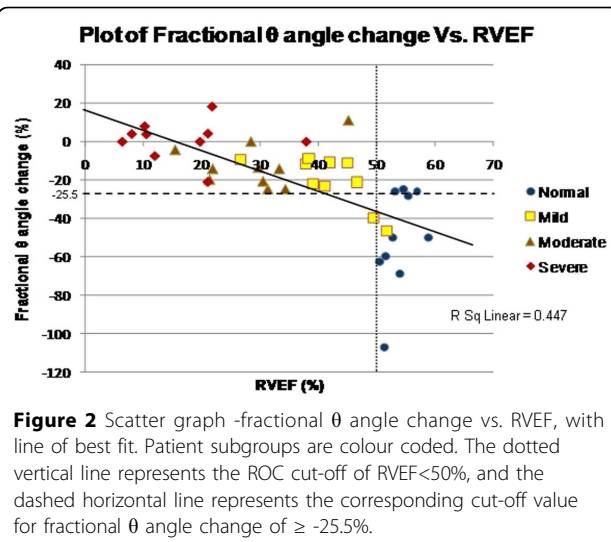


Figure 1 AAAs in ED on a 4chamber view.



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