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Quantification of LVEF≤35% misclassification by 2D-echocardiography as compared to cardiac magnetic resonance in coronary artery disease: implications for AICD therapy

Diane J Parrington, Aramesh Saremi, Sudhakar V Girotra, Sandesh Dev, Charles Oh, Cynthia L Scott, Raymond Q Migrino*

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Background

Cardiac magnetic resonance (CMR) is the noninvasive gold standard for evaluation of LV size/function due to its low interscan/intraobserver/interobserver variability. However, 2D echocardiography (Echo) remains the modality of choice to assess LV function due to ease of use, cost-effectiveness and ubiquity despite its known higher method variability. Randomized trials showed that automated implantable cardiac defibrillators (AICD) provide survival benefit in ischemic/nonischemic cardiomyopathy patients with LV ejection fraction (EF) ≤35%. It is therefore important to correctly classify patients by LVEF≤35% status to avoid improper placement or withholding of placement of AICD. We aim to quantify the misclassification of LVEF≤35% by Echo when compared to CMR in ischemic cardiomyopathy patients.

Methods

Ischemic cardiomyopathy (LVEF<40%) patients had cardiac imaging at baseline and following 6 months of micronutrient supplementation on top of optimal medical therapy as part of a dietary supplementation study. Sixteen sets of same-day CMR and Echo scans were compared (from 8 subjects, all males, 71±8 years). LVEF was measured in CMR using cardiac-gated steady state free precession gradient echo cine and modified Simpson's method, while biplane volumetric method was used in Echo. Correlation, ROC curve and kappa analyses were used.

Results

LVEF was 30.7±9.4% (CMR) and 28.3±9.0% (Echo) (R=0.93, p<0.0001). CMR classified 10/16 while Echo classified 10/16 as having LVEF≤35%. Using CMR as gold standard, Echo misclassified 2 (12.5%) as having LVEF≤35% and misclassified 1 (6.2%) as having LVEF>35%. Kappa statistic for CMR and echo for LVEF≤35% is 0.59, denoting moderate classification agreement. By ROC analysis, an echo EF cutoff of 29% has 80% sensitivity, 100% specificity for detecting CMR LVEF≤35% with AUC of 0.92 (95%CI 0.67-0.99, p=0.001, see figure).

Conclusions

Despite high correlation, Echo misclassified LVEF≤35% in 18.75% of cardiomyopathy cases versus CMR. With 1.2 million MI patients per year in the US and published data of 11% of MI patients having LVEF≤35% 90-days after MI, 132,000 patients potentially require AICD annually. Misclassification of LVEF≤35% by Echo has substantial implications for delivery or withholding of AICD therapy and the prognostic implications need to be formally studied. Short of using CMR in all post-MI patients, based on ROC analysis the misclassification can potentially be minimized by measuring CMR LVEF in patients with Echo EF≥30-40%.

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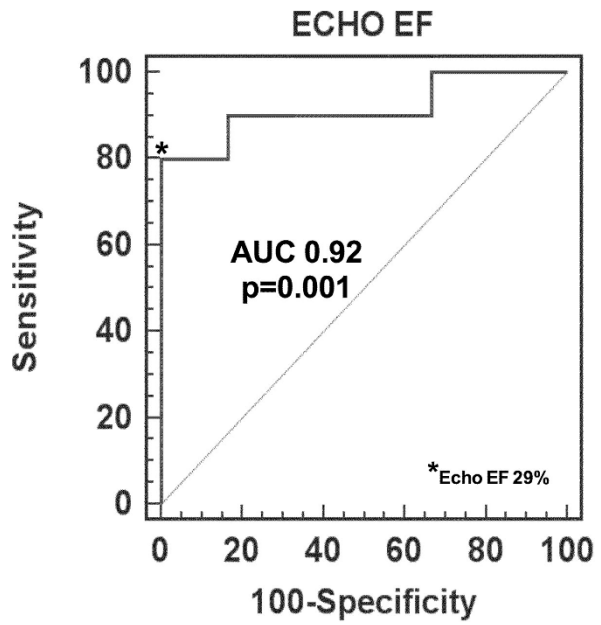

Figure 1 ROC curve analysis of Echo EF predicting CMR EF≤35%. Echo EF≤29% has 80% sensitivity and 100% specificity for predicting CMR EF≤35%.

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