Validation of a Novel Artificial Intelligence Left Ventricular Ejection Fraction Quantification Software (LVivo EF by DIA®) by Cardiac MRI

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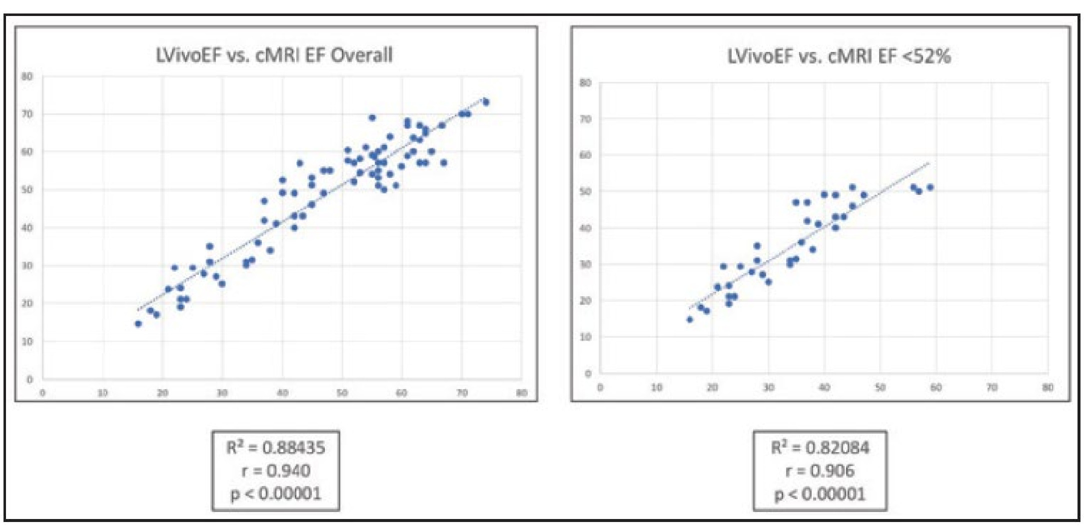
Background: The diagnosis of left ventricular (LV) function and ejection fraction (EF) is the most frequently requested transthoracic echo (TTE) diagnosis, but its quantification can be patient habitus, machine, sonographer, and interpreter dependent. Application of a rapid, on-line artificial intelligence technology to quantify LVEF would remove reader subjectivity and would be an invaluable tool for improving TTE interpretation. Our study aims to determine if artificial intelligence with LVivoEF by DiA® (which can be run across several electronic platforms), correlates well with Cardiac Magnetic Resonance Imaging (cMRI) LVEF, as the gold standard.

Methods: We performed a retrospective single center study of 76 patients (pts) who underwent both routine TTE and cMRI within 6 months with no interval cardiac intervention or clinical event. Pts 4-chamber LVEF's were analyzed by a novel artificial intelligence software, LVivoEF by DiA®, which provides fully automated LV analysis and generates LVEF through pattern recognition, machine learning, and image processing algorithms for automated detection and tracking displaying the endocardial border as an overlay on the moving image.

Using linear regression and chi square, the DIA 4-chamber EF's were compared to the cMRI EFs.

Results: There were 76 patients (59% male, mean age 54.3 years, range 20-88 years), mean LVEF by cMRI was 48.6%, range 14.6 to 73.0%. Using the ASE classification, 42 had a normal EF (>51%), 14 had mildly abnormal (41-51%), 8 moderately abnormal (30-40%), and 13 severely abnormal EF's (<30%) by their cMRI. The correlation between LVivo EF and cMRI derived EF for all pts was $R2=0.890$ ($p<0.00001$), and for those with abnormal cMRI EF (<52%) , $R2=0.821$ ($p<0.00001$) (Figure). LVivoEF also accurately separated EF ≤40% and >40%, $\chi 2=51.1$, $p<0.00001$.

Conclusion: Compared to cMRI as the gold standard, LVivo EF AI software provides accurate LVEF over a wide range of cardiac function. By providing the endocardial border overlay on the moving images, LVivo EF facilitates immediate confirmation by the reader of its accuracy. The strong correlation between LVivo EF AI may expedite more accurate TTE LVEF quantification, particularly in pts with low EF's in whom accuracy has clinical and therapeutic implications.



Fully Automated Echocardiographic Artificial Intelligence Software Could Replace Contrast Agents for Improving Accuracy of Left Ventricular Ejection Fraction Quantification

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Background: Transthoracic echocardiography (TTE) plays an integral role in the diagnosis and management of cardiac disease. However, quantitative analysis of left ventricular ejection fraction (LVEF) is labor intensive, time consuming, and frequently subjective with wide inter and intra-observer variability. Ultrasound contrast agents can improve LVEF analysis, but cost and IV administration limit their use. We sought to determine if LVEF calculated by an artificial intelligence (AI) software (LVivo EF by DIA®) is more accurate than the physicians' measurement (MD-EF), using cardiac MRI (cMRI) as the gold standard.

Methods: This is a retrospective single center study of 76 patients (pts) who underwent both routine TTE and cMRI within 6 months with no interval cardiac intervention or clinical event. Pts' 4-chamber EF's were analyzed using LVivo EF by DiA®, AI software quantification that uses pattern recognition, machine learning, and image processing algorithm for automated detection and tracking of the LV endocardial border to determine LVEF. Using linear regression and the Fisher r to z transformation, AI generated EF's were compared to the EF by cMRI and physician read EF (MD-EF), for both contrast and non-contrast studies.

Results: We studied 76 patients (59% M, 41% F, mean age 54.3 years, range 20-88 years), mean LVEF by cMRI was 48.6, range 14.6 to 73.0. Using the ASE definitions for EF: 42 had a normal EF (>51%), 14 mildly abnormal EF's (41-51%), and 21 moderate-severe abnormal EF's (<40%). For all pts, there was a stronger correlation between LVivoEF and cMRI derived EF (R2=0.890) than by MD-EF (R2=0.790) (p=0.036). Importantly, in non-contrast studies compared to cMRI, LVivoEF (R2=0.823) was significantly better than MD-EF (R2=0.622) (p=0.039), while for contrast studies, LVivoEF (R2=0.913) and MD-EF (R2=0.873) were similar (p=0.453) (Figure).

Conclusion: Compared to cMRI, LVivo EF AI was more accurate than physician measured LVEF's overall and for TTE's without contrast and was similar to MD-EF for contrast enhanced studies. Th us, LVivo EF AI could standardize accurate TTE quantification of LVEF without the added time, IV insertion and expense of contrast agents.