PUBLISHED ABSTRACT

A Novel Artificial Intelligence Echocardiography Software Achieves Equivalence to Physician-Read Images with Ultrasound Enhancing Agents in Left Ventricular Volume Determination

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Background

Left ventricular (LV) volumetric quantification by transthoracic echocardiography (TTE) remains a time-consuming, labor-intensive and ultimately subjective task. Ultrasound Enhancing Agents (UEAs) can improve the quantification but are expensive and require IV administration. Previously, we demonstrated that in select high quality studies, LV ejection fraction (LVEF) determined from a single plane non-UEA apical 4-chamber by an artificial intelligence (AI) software, LVivoEF by DIA®, correlated with cardiac magnetic resonance imaging (c-MR) and was more accurate than physician-derived LVEF from UEA images. Here, using consecutive non-selected patients (pts), we assess the accuracy of AI-derived non-UEA LV volumes compared to physician-derived UEA LV volumes (MD-Vol) with c-MR as the gold standard.

Methods

75 pts underwent both routine TTE with UEA and c-MR within 6 months without interval clinical intervention. Single plane apical 4-chamber non-UEA images were analyzed by LVivoEF, an AI software developed from machine learning that tracks the endocardial border to determine LV volumes. Linear regression and Fisher r to z transformation was utilized to compare AI-generated volumes, c-MR and MD-Vol.

Results

Of the 75 pts (57% men; mean age 54.9 years) analyzed, 41% of pts had an LVEF < 40% with mean LVEF 45% as determined by c-MR. The AI-derived LV end-systolic (LVESV) and end-diastolic volumes (LVEDV) in non-UEA images correlated well with c-MR ($R2 = 0.752$ and $R2 = 0.661$, respectively) (**Figure 1**). The physician-derived UEA LVESV and LVEDV also correlated with c-MR ($R2 = 0.834$ and $R2 = 0.712$, respectively) (**Figure 1**). The differences in Pearson's r between non-UEA AI/c-MR and UEA MD-Vol/c-MR volumes were not significant ($p = 0.093$ for LVESV and $p = 0.285$ for LVEDV).
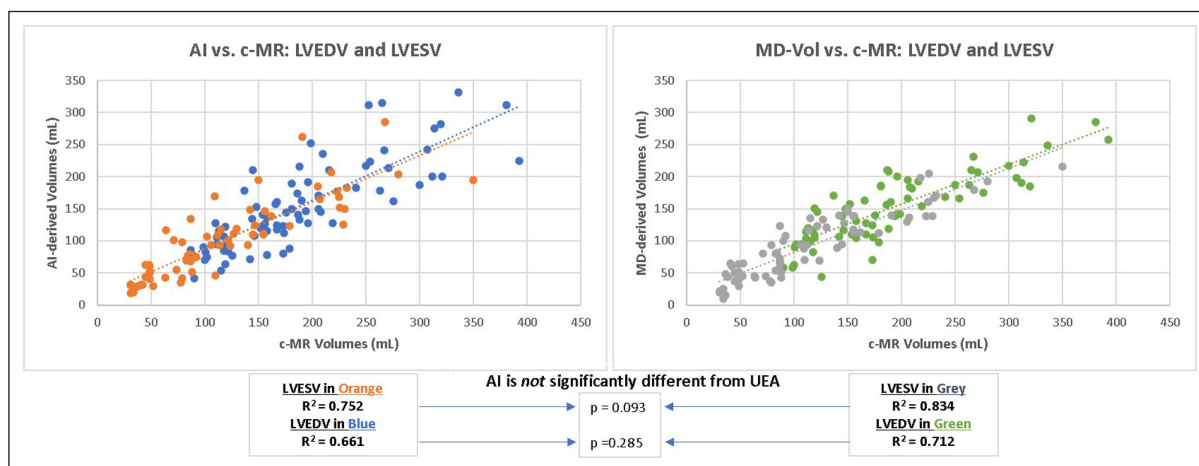

Figure 1: AI-derived volumes from non-UEA images is not significantly different from physician-derived volumes from UEA images.

Conclusions

AI LVivoEF by DIA® correlates with c-MR in the quantification of LV volumes from a non-UEA single plane apical 4-chamber and is not significantly different from physician-derived UEA LV volumes in a consecutive non-selected population. Therefore, LVivoEF may provide a non-invasive, less expensive, and faster alternative to physician-derived UEA volumetric quantification.