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3D-rendered Electromechanical Wave Imaging Within 24 Hours Of Cardiac Resynchronization Therapy Implant For Response Prediction

Author Block: Lea Melki, MS, MPhil, Daniel Y. Wang, MD, MS, FHRS, Christopher S. Grubb, MD, Rachel Weber, BA, RDCS, RVT, Elaine Wan, MD, FHRS, Hasan Garan, MD, MS and Elisa Konofagou. Columbia University, New York, NY, White Plains Hospital, New York, NY, Columbia University, Cardiology, New York, NY
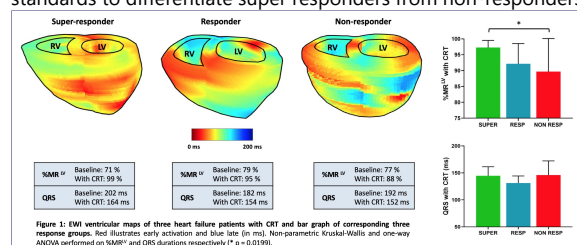
Abstract:
Background: Electromechanical Wave Imaging (EWI) is a high frame rate ultrasound technique capable of non-invasively quantifying and visualizing myocardial resynchronization (%MR).
Objective: QRS complex narrowing is the current standard of care for Cardiac Resynchronization Therapy (CRT) response assessment. Yet, a third of patients do not respond despite a narrowed QRS on their post implant ECG. This study tests the feasibility of predicting CRT response with the EWI-based %MR metric on the implant day.
Methods: Thirty heart failure patients with left bundle branch block underwent EWI before and after CRT within 24h of their implant procedure. All patients presented with decreased LV ejection fraction (LVEF). QRS durations were measured with 12 lead ECG before and after CRT. EWI activation maps were 3D-rendered with and without CRT. %MR^{LV} was computed in both cases by quantifying the percent of LV myocardium activated within 120 ms of QRS onset.
Results: Mean age was 71 ± 11 yr with 77 % male. Mean LVEF at baseline was 25.3 ± 8.2 %. LVEF improvement at 3, 6 or 9-mo follow up with values ≥ 45% defined super responders (N=9), absolute 5% increase otherwise defined responders (N=7), while stable or decreased LVEF defined non-responders (N=14). %MR^{LV} with CRT significantly ($p < 0.02$) distinguished super responders (97.2 ± 2.3 %) from non-responders (89.6 ± 10.5 %), while the clinical standard QRS metric did not show any distinct trend between the 3 groups (Fig. 1).

Conclusion: EWI provides 3D visualization of ventricular ressynchrony immediately after CRT. %MR^{LV} can serve as a reliable response predictor over clinical standards to differentiate super responders from non-responders on the implant day.

Figure 1: EWI ventricular maps of three heart failure patients with CRT and bar graph of corresponding three response groups. Red illustrates early activation and blue late (in ms). Non-parametric Kruskal-Wallis and one-way ANOVA performed on %MR^{LV} and QRS durations respectively (* p = 0.0199).

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Author Disclosure Information:

L. Melki: Nothing relevant to disclose.
Category (Complete): Surgical & Other
Keywords (Complete): R -> Resynchronization Therapy ; E -> Echocardiography, transthoracic
Additional Information (Complete):
    Presentation Preference: Oral or Poster
    Proof of Concept/Innovation : True
    At the conclusion of this presentation, attendees will be able to: (Maximum character limit 250)

*Learning Objective: : Understand how Electromechanical Wave Imaging can assist clinicians in visualizing and assessing response on the day of CRT implant.

Abstract Awards (Complete):
    None : True

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