Echocardiographic Assessment Of LBBB Related Strain Dyssynchrony In Patients

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Patients with left bundle branch block (LBBB) have reduced cardiac performance due to dyssynchronous left ventricular (LV) activation. Treatment of LBBB through cardiac resynchronization therapy (CRT) has a non-response rate of 20-40%. Recent studies have shown the use of indices of myocardial strain in predicting CRT response with speckle tracking echocardiography (STE). Studies have so far focused on longitudinal strain. In this study, circumferential strain patterns obtained in patients with ultrasound (US) and tagged-MRI (MRI-T) were compared, as circumferential strain (e_{cir}) has been shown to be more sensitive to dyssynchrony. Additionally, the influence of STE software and regularization was examined.

Patients (n=21, median age 67 years) referred for CRT were included. All patients provided written informed consent for the use of their data for scientific purposes. US DICOM data were acquired in the parasternal short-axis view (Philips iE33 scanner, S5-1 transducer) at 50-90 Hz. MRI-T data were acquired with a 1.5T Philips Ingenia MRI scanner at 52 Hz and analyzed using SinMod (Maastricht University). Tag line dispersion meant heart cycles were incomplete. US strain analysis was performed using two methods, commercial software and a basic block-matching algorithm. Three regularization methods were applied to the basic algorithm, windowed median filtering, Fourier-based, and cubic spline smoothing. Per frame displacements were calculated using a coarse-to-fine algorithm. e_{cir} curves were compared between methods, in the standard six segments and septal/lateral walls. Systolic strain (SS), the difference between minimum and maximum e_{cir}, and septal rebound stretch (SRS), positive e_{cir} prior to aortic valve closure, were analysed

US e_{cir} showed good agreement with MRI-T globally (mean ρ=0.95) and in the septal (mean ρ=0.85) and lateral (mean ρ=0.79) walls. LBBB-type strain patterns were observed in many patients, in particular double peaked systolic shortening (Figure 1A). SS differed in magnitude and bias (Figure 1B), whilst SRS showed poor agreement with MRI-T (Figure 1C). Both varied with STE software and regularization. Further open efforts are needed to determine the underlying differences between STE software before strain parameters can be used widely in the clinic.

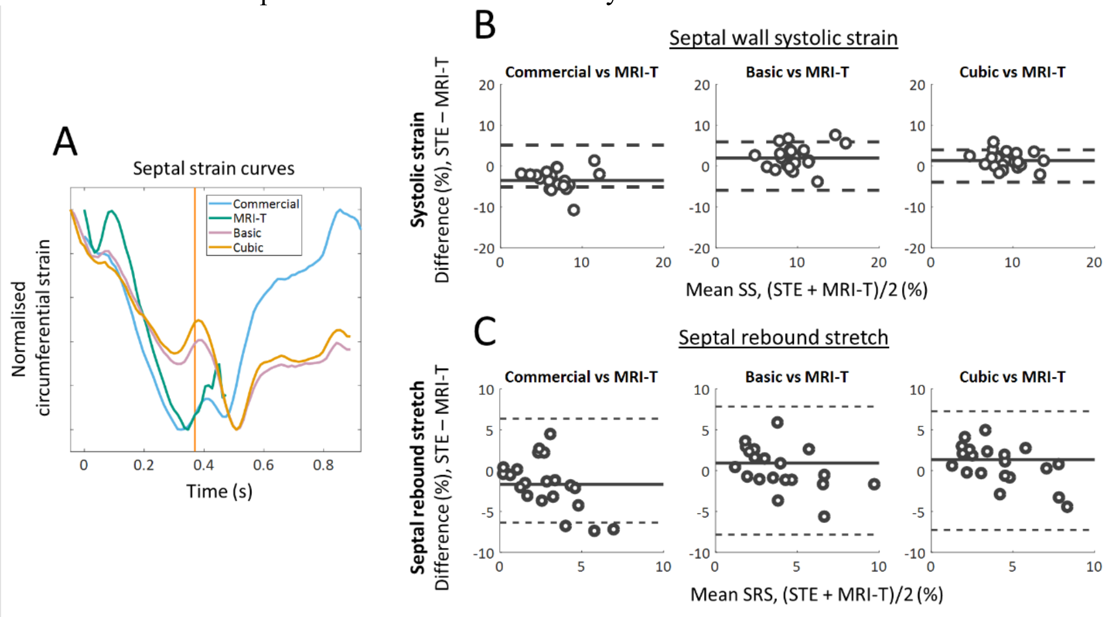

Figure 1: A: Representative strain curves obtained with the Commercial, MRI-T, Basic and Cubic methods. **B:** Bland-Altman plots of systolic strain in the septal wall. **C:** Bland-Altman plots of septal rebound stretch. Median filtering and Fourier regularization were omitted for clarity.