Evaluating diastolic and systolic reserve by strain imaging during resistance exercise training in heart failure with preserved ejection fraction

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Background: Exercise intolerance is the cardinal manifestation of heart failure (HF), yet its underlying mechanism(s) remain poorly understood. Measures of ventricular function such as ejection fraction often have no relationship with exercise capacity in HF. 2D-STE has proved to be more reliable method to evaluate myocardial mechanical function. Our hypothesis is Resistance exercise training (Resist-HFpEF) will improve exercise tolerance and exertional symptoms in patients with HFpEF.
Purpose: The study aims to evaluate myocardial mechanical function by strain imaging during resistance exercise training in Heart Failure patients with Preserved Ejection Fraction (HFpEF)
Methods: This is a single centre prospective pilot study. 24 HFpEF patients were enrolled and their baseline comorbidities were recorded. Baseline 2D-STE imaging was performed at rest and during exercise (Visit 1). Patients were then randomized to either a novel resistance exercise training program for 36 sessions (3 sessions per week for 12 weeks) or a standard of care control group. 2D STE imaging was then repeated at follow-up (Visit 2). Peak Global Longitudinal strain (GLS), systolic strain rate (SSR), early diastolic strain rate (SRe) were measured offline.
Results: Mean age of the Rehab cohort was 68.57±10.52 years and the control cohort was 68.1±6.47 years. 23 study subjects were male (96%). 17% of the study subjects were hypertensive, 63% were diabetic, 42% had NYHA I, 46% had NYHA II and 13% had NYHA III of heart failure. The mean LV ejection fraction in the control and Rehab group after the training program at rest was 61.88±2.26% & 54.74±2.07% (p-value 0.04) and during exercise was 59.90±2.05% and 53.13±2.05% (p-value 0.04). The peak GLS was –18.80±4.29% and –17.7±2.21% in controls during rest and exercise at Visit 1 (p-value 0.27) while the rehab cohort had –18.71±4.7% and –20.82±2.4% respectively (p-value 0.0268). The peak GLS was –17.40±3.05% and –17.96±2.65% in controls during rest and exercise at Visit 2 (p-value 0.3430) while rehab cohort had –17.97±6.21% and –16.57±3.82% respectively (p-value 0.67). (Figure 1a and 1b shows GLS, SRS, SRe at Baseline and after exercise program respectively)
Conclusion: This pilot study suggest systolic and diastolic reserve can be measured reliably during low grade exercise. These results could reflect improvement in clinical status and exercise tolerance.

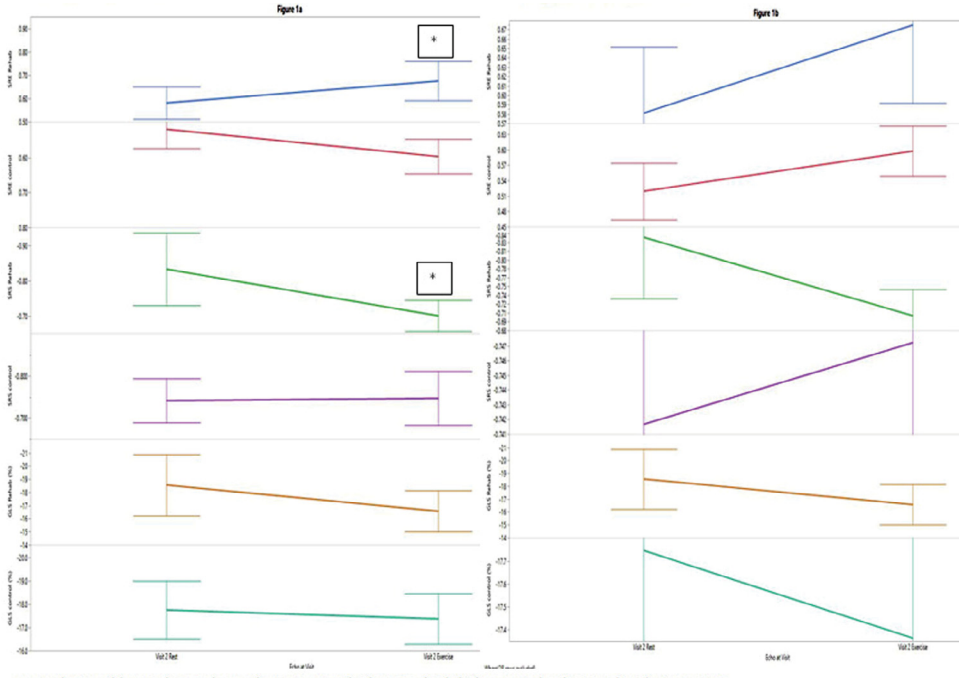

Figure 1. Comparison of peak GLS, SSR, SRe amongst HFpEF patients at rest and during exercise before and after the rehab training program.