Left Ventricular Outflow Tract Obstruction Leads to Decreased Myocardial Strain in Right Ventricles: Comparison of Coarctation of the Aorta, Hypoplastic Left Heart Syndrome and Normal Patients

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Background: Myocardial strain assessment is used for occult ventricular function in congenital heart disease and is more sensitive than ejection fraction. Strain abnormalities may an early indicator of ventricular failure. Recently, strain has been shown to be abnormal in hypoplastic left heart syndrome (HLHS) at various stages of repair. Right ventricular (RV) failure is common in patients with HLHS. Early detection of dysfunction may improve understanding of post-operative management. We sought to determine if there is progressive RV strain decline with degrees of left ventricular (LV) outflow tract obstruction.

Methods: Pre-operative echocardiograms from patients with Coarctation of the Aorta (CoA), HLHS and normal patients were analyzed using TomTec, strain software from a long axis (4 chamber) based on previously described technique. Statistical analysis was performed to compare longitudinal strain value across all three groups.

Results: There was no difference in age of the HLHS, CoA and normal infants. Strain and strain rate were both significantly decreased (P < 0.0001, P = 0.018, One-way ANOVA) in the HLHS population (-11.1±0.4; -1.1±0.1) and CoA (-12.3±0.9; -1.4±0.1) compared to normal hearts (-15.3±0.7; -1.4±0.1), although not significantly different from each other. There was no difference in strain or strain rate amongst the subtypes of HLHS patients.

Conclusions: These results show a correlation of LV outflow tract obstruction with lower strain, despite normal function. As RV function is an independent risk factor for survival in lesions with LV outflow tract obstruction, having a pre-operative myocardial strain abnormality suggests that the at-risk RV may benefit from initiation of cardio-protective therapy. Future longitudinal studies are needed to determine the utility of myocardial strain to predict outcomes.