Dynamic evaluation of moderate aortic stenosis in the young with treadmill exercise challenge

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Objectives: The optimal time of intervention for moderate aortic stenosis (modAS) is unknown. We sought to investigate the discriminant value of biomarker levels (NT-proBNP and hs-TnT) following exercise challenge in children with asymptomatic modAS. The aim of this study is to determine optimal timing for biomarker measurement after peak exercise and to determine the discriminant value of biomarker response to exercise challenge in a pediatric population with modAS.

Methods: Three groups (N=8-10 each) were compared: (1) Moderate aortic stenosis (modAS) with mean LV-Ao gradient of 20 to 39 mmHg, (2) moderate aortic regurgitation without stenosis (A-Reg) and (3) control group (CTL) matched for age and gender. Subjects were excluded in the case of coexisting conditions potentially influencing biomarker levels. Blood samples were obtained at rest and at 20, 40 and 60 minutes after peak exercise. Echocardiography with 2D strain and functional data was obtained at rest and 2-3 minutes after exercise testing.

Results: Exercise performance was equivalent in all groups. Exercise testing yielded ST segment depression in 1 modAS subject. Holter monitoring showed rapid non-sustained ventricular tachycardia in another modAS subject. No difference was noted between groups for biomarkers levels at baseline. NT-proBNP increase in response to exercise was significant only in modAS, (57.8±38.9ng/L at rest vs 62.7±41.8ng/L at 40-min; p=0.02). Despite relatively higher NT-proBNP in A-Reg at rest, levels did not vary after exercise (91.1±62.9ng/L vs 91.2±57.73 at 60-min; p=0.98) (figure1). Hs-TnT did not yield a significant difference in any group or between groups. Strain was altered on global longitudinal assessment in modAS and modAR compared to CTL at rest (-19.1±2.9% and -19.8±2.3% vs -22.3±1.3%, respectively; p=0.013) and following treadmill challenge (-19.2±3.0% and -19.0±2.5% vs -22.6±2.0%; p=0.008). No significant differences were observed within groups after exercise challenge.

Conclusion: NT-proBNP following exercise challenge is a discriminant biomarker of modAS from A-Reg and CTL. This difference becomes significant from 40 min after peak exercise onward. 2D-Strain shows significantly reduced GLS in modAS and A-reg compared to controls at rest and after exercise challenge. This novel way to differentiate patients with moderate AS from controls offers a promising avenue for future stratification of moderate AS patients and more optimal interventional timing.