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A Stress Echocardiography study of Exercise Capacity and Cardiac Function following Arterial Switch Operation for simple Transposition of the Great Arteries

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INTRODUCTION: The arterial switch operation (ASO) for repair of transposition of the Great Arteries (TGA) was designed to restore the morphological left ventricle as the systemic ventricle and improve cardiac function and longevity. The aim of this study was to assess cardiac and hemodynamic responses to exercise and exercise capacity in a cohort of children who had undergone an ASO.

METHODS: We retrospectively reviewed stress echocardiograms performed in 19 children with ASO for simple TGA (Patients) during semi-supine cycle ergometry (SSCE) and compared them to healthy controls (Controls) (n=29). Subjects exercised on a semi recumbent cycle ergometer to volitional fatigue. Workload was progressively increased every three minutes, by 20 to 40 Watts. Echocardiography, Doppler, heart rate (HR) systolic (SBP) and diastolic (DBP) blood pressures were taken at rest, 1.5 minutes into each stage, immediately, and 3 minutes post-exercise. LVEDI, LVESI, shortening fraction (SF), rate corrected mean velocity of circumferential fibre shortening (MVCFC), wall stress at peak systole (sPS), stroke volume index (SVI), and cardiac index (CI) were obtained. Segmental wall motion was assessed.

RESULTS: At rest, SBP and DBP was lower in patients (108 vs 118 bpm, p=0.05; 60 vs 76 bpm, p<0.001, respectively). LVEDI and LVESI were larger in the patients (p=0.03), while SF, MVCFC, and sPS were similar. Resting HR was lower in patients (66 vs 80 bpm; p=0.001), SVI was higher (46 vs 39 ml/m²; p=0.02), and CI was similar. Patients performed less cumulative work (941 vs 1228 J/kg; p=0.02). At peak exercise, DBP (64 vs 76 mmHg; p<0.001) was lower, LVEDI and LVESI were higher in the patients (3.3 vs 2.9 cm/m²; p=0.009; 1.7 vs 1.4cm/m²; p=0.001, respectively). SF was also lower in the patients (46 vs 50%; p=0.04) and wall stress was higher (73 vs 52; p<0.001). HR was lower in the patients (141 vs 182 bpm; p<0.001), while SVI and CI were similar between groups. Segmental wall motion was normal.

CONCLUSIONS: Despite a lower cumulative workload, HR and SF, the exercise capacity and functional responses were normal in many of the patients. Assessing wall motion during SSCE may help screen for coronary artery insufficiency.