

Cardiovascular Health in Patients with Congenital Heart Disease Requiring Surgical Intervention: a Longitudinal Study Design

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Congenital heart patients have the same cardiovascular risk factor profile for developing acquired cardiovascular disease (CVD) as the general population, and there is emerging data that they may have increased intrinsic risk based on their congenital anomaly. Non-invasive assessment of vascular health, which includes assessment of blood vessel wall structure and function, have recently become available. Arterial structure can be assessed by ultrasound measurement of carotid intimal-medial thickness (cIMT). Arterial function can be measured by pulse wave velocity (PWV) which reflects arterial stiffness and has been identified as an independent predictor of subsequent CVD and mortality. Speckle tracking echocardiography (reported as global longitudinal strain (GLS) of left ventricle (LV) or right ventricle (RV)) has recently emerged as a quantitative technique to accurately estimate myocardial function. Given the epidemic of precursor conditions for the development of CVD in our surgical congenital heart patients, including sedentary lifestyle and obesity, risk stratification will be critical to be able to target higher risk patients for primary prevention. We hypothesize that patients with congenital heart disease requiring cardiac surgical intervention will have altered arterial structure and function and altered cardiac function compared to aged-matched controls. Our secondary hypothesis is that this altered vascular structure and function will be more pronounced in a preterm birth cohort. A prospective longitudinal observational study design of 200 subjects (ages 1-60y) will be performed (100 study patients with congenital heart disease requiring surgical intervention, and 100 age/gender matched controls). "Ideal cardiovascular health" score will be calculated to stratify CVD risk based on BMI and blood pressure measurements, blood work (fasting glucose, total cholesterol) and questionnaire report of 3 health behaviors (smoking, physical activity, diet). PWV, echocardiography and carotid vascular ultrasound will be performed longitudinally on each subject for each research visit; pre-operation, two-months post-surgery, and annually for 3 years. 5 patients have been enrolled (06/2022-09/2022) and completed two research visits (age 9.8 ± 7.2 yrs, BMI 19.4 ± 6.9 kg/m²). There were no differences between the two visits measurements (LV ejection fraction 59.1 ± 7.1 vs. $61.8 \pm 6.9\%$; LV GLS -22.1 ± 2.0 vs. $-23.1 \pm 1.6\%$; RV GLS -26.6 ± 4.0 vs. -27.1 ± 5.0 ; carotid-femoral PWV 4.7 ± 0.8 vs. 4.5 ± 0.7 m/s; total mean cIMT 0.47 ± 0.06 vs. 0.49 ± 0.05 mm, all $p > 0.005$). We learned that the lower size limit for PWV assessment is 8kg, a limit that has not previously been published. All our proposed measurements are possible in patients > 8 kg. We anticipate that enrollment will require 2 years (at an average of 4 patients per month).