Isovolumic Acceleration at Rest and During Exercise in Children after Heart Transplant

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Background: Progressive graft failure is an important clinical problem in pediatric heart transplantation. The myocardial systolic and diastolic reserve during exercise has been poorly studied in the transplanted heart while it could provide important information. Left ventricular (LV) myocardial acceleration during isovolumic contraction (IVA), is a TDI derived index, while correlates well with indices of myocardial contractility. It can be used to study the force frequency relationship (FFR), which reflects the increase in contractility with increasing heart rate. The aim of the current study was to evaluate myocardial contractile response to exercise in children after HTX using semi-supine cycle ergometry stress echocardiography (SSCE).

Materials and Methods: A total of 43 pediatric HTx recipients and 24 age and gender matched controls were included. Median age at transplantation was 9 years (birth to 15 years) and median time since transplant was 4.9 years (0.5 to 15.4 years). A stepwise SSCE protocol was used. LV IVA was measured in all the subjects at rest and at incremental heart rates. FFR was constructed by plotting LV IVA against heart rate.

Results: Resting HR (mean ± SD) was higher in the HTx group than in the controls (90 ± 14 vs 72 ± 10 bpm, p<0.001) and peak HR was lower in the HTx group than in CON (141 ±12 bpm vs 165±15 bpm, p<0.001). LV IVA values were significantly higher at rest in the transplant group (HTx 1.22±0.64 cm/s vs. 0.79±0.31 cm/s p=0.001) but were significantly lower at peak exercise (2.4±1.02 cm/s vs. 5.2±1.41 cm/s p=<0.001). The contractile response as studied by the FFR, was significantly blunted in HTX compared with controls, p=<0.001. (See figure).

Conclusions: Our data suggest a significantly different LV contractile response to exercise in HTX compared with controls when studies using the FFR. This suggests subclinical myocardial dysfunction in the grafts, which could have important prognostic implications.