Abnormal myocardial rotation is a non-invasive marker of rejection in paediatric heart transplant recipients.

The Hospital for Sick Children, Toronto, Canada

Background: Graft function may be compromised for a variety of reasons after heart transplantation, including rejection. The objective of the current study was to assess cardiac function and the relationship with the presence and degree of rejection as determined by endomyocardial biopsy in paediatric heart transplant recipients.

Methods: Cardiac magnetic resonance (CMR) imaging was performed in 14 patients (11 male; mean age 13.9 years±4.7 (range 2.4-17.9 years), 1.2 years±1.3 (range 12 days-5.0 years) after heart transplantation. CMR was obtained at the time of routine endomyocardial biopsy for rejection surveillance. A total of 18 combined CMR studies / biopsies were performed). In addition to biventricular systolic function and dimensions, left ventricular (LV) circumferential strain, rotation, twist and torsion were measured using myocardial tagging (Figure). The results were compared to those of 9 age-matched controls. All transplant patients also underwent routine cardiopulmonary exercise testing.

Results: Heart transplant patients showed lower LV and right (RV) ejection fraction (EF): LVEF 55±8 vs. 61±3%, p<0.01, RVEF 48±7 vs. 53±6%, p=0.03) and increased LV mass, indexed to body surface area (67±14 vs. 55±13 g/m², p=0.01). Global LV circumferential strain (-13.5±2.3 vs. -19.1±1.1%, p<0.01), basal strain (-13.7±3.0 vs. -17.5±2.4, p=0.01), mid-ventricular strain (-13.4±2.7 vs. -19.3±2.2, p<0.01) and apical strain (-11.8±7.2 vs. -19.9±2.0, p<0.01) were significantly reduced in patients when compared with controls. In addition, LV rotation (6.1±1.65 vs. 7.8±1.13°, p<0.01) was decreased and basal rotation was abnormal (-2.0±2.1 vs. -5.0±2.0°, p<0.01) in patients compared with controls. Transplant patients also showed decreased LV torsion (6.1±1.65 vs. 7.8±1.13°, p<0.01). Heart transplant recipients had reduced predicted peak work load (58±12%), predicted peak oxygen consumption (PVO2) (55±12%) and predicted PVO2 at aerobic threshold (57±14%) as compared to a paediatric reference population. The severity of rejection correlated inversely with LV twist (r= -0.53, p=0.02) as well as basal (r= -0.48, p=0.04), mid-ventricular (r= -0.56, p=0.02), and apical rotation (r= -0.65, p<0.01).

Conclusion: Paediatric heart transplant recipients have mildly reduced systolic global biventricular function, increased LV mass, abnormal rotation, strain, torsion and twist, as well as impaired exercise performance. Abnormal rotation appears to be a non-invasive marker of graft rejection.