Cardiac magnetic resonance characteristics of the transplanted heart: first results of the prospective Heart-TIming CMR substudy

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Topic(s):
Heart Transplantation

Citation:

Funding Acknowledgements:
Project no. NVKP_16-1-2016-0017 has been implemented with the support provided from the National Research, Development and Innovation Fund of Hungary

Background: In case of heart transplantation (HTX) the heart is affected by several factors e.g. ischaemia/reperfusion, denervation, immunosuppression. During the adaptation, the heart may show marked temporal changes in terms of myocardial mechanics, function and tissue characteristics. To better understand temporal characteristics after orthotopic bivacal HTX we started the prospective Heart-TIming (Transplantation Imaging) trial in January 2018 including standard 12-lead ECG, 24-hour Holter monitor, endomyocardial biopsy, transthoracic echocardiography, invasive coronary angiography with intravascular ultrasound and optical coherence tomography and cardiac magnetic resonance (CMR).

Aim: In our CMR substudy we aimed to evaluate the physiological structural and functional left and right ventricular characteristics and their temporal changes after HTX using CMR.

Methods: As part of the study HTX patients underwent CMR at 1, 3 and 6 months after HTX (n=31; 52±10.5y, 25 male). Cine images, T2-weighted, late gadolinium enhancement (LGE) and adenosine stress perfusion (at 1 month) images were acquired. In order to describe physiological characteristics of the transplanted heart we excluded pts with significant coronary artery disease, ischaemic scar, =Grade II allograft rejection from this present study (n=6). We assessed the left (LV) and right ventricular (RV) ejection fractions, volumes, masses (M) and LV strain. We assessed the global strain values: longitudinal, circumferential (GCS) strain and the standard deviation (SD) of the peak longitudinal strain (LS) and the left ventricular mechanical dispersion. We compared baseline volumetric and strain parameters to age matched healthy controls (n=20; 47±11.4y, 15 male), and the temporal changes between one, three and 6 months.

Results: Comparing the HTX patients’ CMR parameters at one month with normal controls, HTX patients had lower LV and RV end-diastolic volumes (LVEDVi: 76.6±15.9 vs 90.6±11.6ml/m2; RVEDVi 74.5±17.5 vs 90.3±12.1ml/m2p<0.05),stroke volumes (p<0.05) and higher LVMi (67.6±14.4 vs 57.2±11g/m2, p<0.05). CMR based strain analysis of the HTX pts showed hyperkinetic GCS (–40.5±6.3% vs –35.2±4.8%,p<0.05), increased SD of peak LS and more pronounced mechanical dispersion (p<0.001) compared to the controls. Examining temporal changes in HTX pts we found a decrease in LVMi (69.57±16.4 vs 61.7±9.8g/m2, p<0.05) already at three months, normalization of GCS (–37.7±5.5% vs –32.6±4.9%, p<0.05) and decrease in SD of peak LS (13.5±2.3 vs 11.4±2.4, p<0.05) at 6 months. Oedema was present in all pts at one month after HTX, and disappeared after three months. LGE with aspecific pattern was present in 42%.

Conclusions: Understanding the temporal changes of LV mechanics, function and tissue characteristics, furthermore the establishment of physiological values may help in the early, noninvasive identification of pathological changes in HTX pts.
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(NCT number): NCT03499197