Halftime review

Echocardiographic assessment of ventricular size and function in heart transplant patients

Annika Ingvarsson

Department of Clinical Sciences, Cardiology

Main Supervisor:
Carl Meurling, MD, PhD, Ass Prof

Reviewers:
Jesper Van der Pals, MD, PhD, Ass Prof
Arash Mokhtari, MD, PhD

Co-Supervisors:
Anders Roijer, MD, PhD
Göran Rådegran, MD, PhD, Ass Prof

Department of Cardiology, Lund University, Lund
6th May 2019
Background

Heart transplantation (HTx) induce structural (i.e. remodeling) and functional changes (e.g. reduced contractility) of the heart. Non-invasive assessment following HTx include transthoracic echocardiography (TTE). Several factors might affect myocardial function in HTx patients rendering the use of normal values for TTE derived from healthy subjects unsatisfactory. Recent reference values have been divided into gender but the disparity in relation to gender and gender mis-match between donor and recipient has not been studied in the HTx cohort.

Objectives and Method:

We aimed to 1) define reference values for TTE in HTx patients and evaluate the novel echocardiographic parameter speckle tracking derived strain in this cohort; 2) study differences in echocardiographic characteristics of HTx recipients in relation to gender and gender mismatch; 3) describe the process of adaptation in the transplanted heart during the first year after HTx.

Results:

In paper 1, HTx patients had larger atrial dimensions, smaller left ventricular (LV) diastolic volume and increased LV wall-thickness. LV ejection fraction (EF) and LV global longitudinal strain (GLS) were reduced. Right ventricular (RV) size measures were greater and conventional function parameters and strain from the RV lateral free wall (RVfree) were lower than normal reference values. In paper 2, male recipients had larger LV mass, thicker septal wall and larger LV volume. A slightly higher LVEF was detected in female recipients vs. male recipients but no differences were observed for conventional RV function parameters. Ventricular strain was higher in females than in males and the male group receiving a female donor heart had comparable EF and strain parameters to the female group.
receiving a gender-matched heart. In paper 3, interim analysis indicate that LV function parameters remained stable between 1 and 12 months after HTx whereas a continuous improvement in RV function parameters, including strain, was seen.

**Conclusion:**

The distribution of several routinely used echocardiographic measures differ in stable HTx patients as compared to healthy subjects and are related to recipient gender. The observed differences could be clinically relevant in the assessment of HTx patients and therefore suggests that specific gender divided reference values should be applied in this context.

**Articles:**


**A Ingvarsson, A Werther Evaldsson, G Rådegran, JG Smith, J Waktare, A Roijer, C Meurling.** “Adaptation of ventricular function the first year after heart transplantation assessed with echocardiography”. In Manuscript
Objectives of remaining projects in my thesis (preliminary paper IV or V) and future postdoc projects:

- The objectives of **paper IV** is to evaluate if speckle tracking derived strain can be used to detect discrete local changes in ventricular contractility related to cardiac allograft vasculopathy (CAV). Diagnosis of CAV is at present diagnosed using coronary angiography or computed tomography (CT) but recently magnetic resonance imaging (MRI) has evolved to detect areas affected by CAV (i.e. fibrosis). Since accessibility of MRI is limited we wish to evaluate if echocardiographic strain measurement correlate to findings from MRI examinations and can be used to detect CAV. Approximately 50 patients will be included and data will be analyzed autumn 2019.

- The objectives of **paper V** is to study how pre-treatment with left ventricle assist device (LVAD) affect RV adaptation in the first year after HTx. The support of an LVAD could theoretically reduce left ventricular filling pressure resulting in reduced pulmonary capillary wedge pressure (PCWP). A high PCWP can lead to irreversible changes of the pulmonary vascular bed resulting in reduced RV function due to higher pulmonary resistance post HTx. Echocardiographic data will be compared to invasive hemodynamic measures regarding pulmonary vascular resistance, pulmonary capillary wedge pressure and left ventricular filling pressure. Data collection are ongoing since 2013 and a draft including approximately 40 patients should be ready spring 2020.

- The objectives of **paper VI** is to evaluate if speckle tracking derived strain can detect acute treatment requiring rejection. Endomyocardial biopsy is gold standard to diagnose rejection and several non-invasive methods have been studied but failed to detect acute rejection. In theory rejection should lead to reduced myocardial contractility but due to hormonal influence the possibility of the opposite (i.e.
increased contractility) cannot be excluded. Since rejection primarily affect longitudinal muscle contractility acute rejection might be detected using differences between longitudinal and circumferential strain. The study is ongoing since 2013 and will be analyzed when > 20 patients are included.

- The objective of paper VII is to evaluate conventional echocardiographic parameters of diastolic dysfunction in the transplant cohort. In patients with coronary artery disease and hypertensive heart failure diastolic dysfunction is well described but data for HTx patients are currently lacking. Detecting diastolic dysfunction is crucial since its presence correlates to both morbidity and mortality. Data will be evaluated against invasive hemodynamic measures of left ventricular filling pressure. Data collection is ongoing and approximately 100 patients will be included.