

# Evaluation of Patients with Systemic Sclerosis Prior to Hematopoietic Stem-Cell Transplantation Using Cardiac Magnetic Resonance Imaging

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## INTRODUCTION

The expanding role of hematopoietic stem-cell transplantation (HSCT) for treatment of autoimmune diseases such as scleroderma necessitates efficient cardiac pre-assessment, due to transplant-related cardiovascular complications and even mortality in high-risk patients. Pulmonary hypertension (PH) is considered a major risk factor for HSCT and current guidelines recommend using echocardiography followed by invasive right heart catheterization (RHC) for risk stratification of these patients.

## PURPOSE

To evaluate the utility of cardiac MRI (CMR) as a tool for detection of PH and risk stratification in patients with systemic sclerosis (SSc) prior to HSCT

## METHODS AND MATERIALS

Twenty one patients with SSc who underwent CMR as part of their pre-HSCT cardiovascular evaluation and 10 controls were evaluated. Post/pre-HSCT brain natriuretic peptide (BNP) ratio as the indicator of ventricular strain was calculated in 16 patients. All patients had RHC within 2 weeks of MR study and were divided into 3 groups based on their Mean Pulmonary Arterial Pressure (mPAP): Mild-PH, mPAP > 25; Borderline-PH, mPAP = 20 – 25; No-PH, mPAP < 20. Right ventricle (RV) volumetric & pulmonary artery (PA) flow analysis was carried out and following parameters were calculated: time to peak systole (TPS), ejection fraction (EF), full width at half maximum (FWHM), downslope (DS), upslope (US), time to peak velocity in systole (TPVS) and diastole (TPVD), Acceleration and Ejection time (AT & ET). These values were compared among groups and then correlated with mPAP values in all patients.

## RESULTS

There were 3 deaths in the patient group (2 mild-PH, 1 borderline-PH). Mild & borderline-PH groups had higher values of TPS, FWHM/EF ratio, TPVD, AT, ET, BNP ratio and lower values of DS and US when compared to controls and RV volume curves showed displacement towards end of cardiac cycle and systolic prolongation. These differences were more pronounced in patients who died. No significant difference was found between mild and borderline PH groups and also between no-PH and control groups. Values of TPS which correspond to duration of systole demonstrated strong correlation with mPAP ( $r=0.71$ ) and moderate correlation with PVR ( $r=0.58$ ).

## CONCLUSION

RV volumetric parameters as measured by CMR are useful for differentiating patients in various stages of PH. The displacement of RV systolic curve towards end cardiac cycle which correlated with higher values of BNP ratio may predict post-transplant RV dysfunction and worse outcomes in PH patients and can be used to noninvasively detect PH.

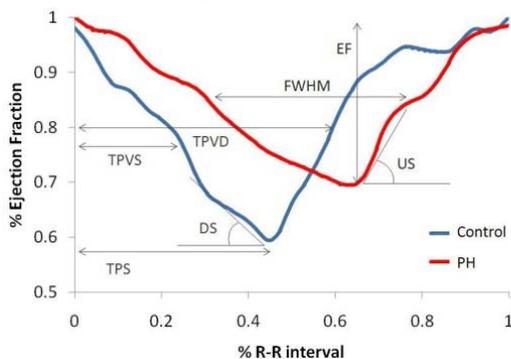


Figure 1 Graph shows comparison of RV volume-time curves between a patient with PH and a control and quantification of RV volumetric parameters

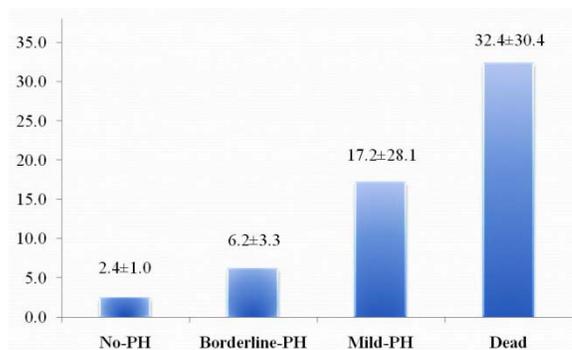


Figure 3 Bar graphs for post/pre-transplant B-type natriuretic peptide (BNP) ratio in subgroups of patients with systemic sclerosis.

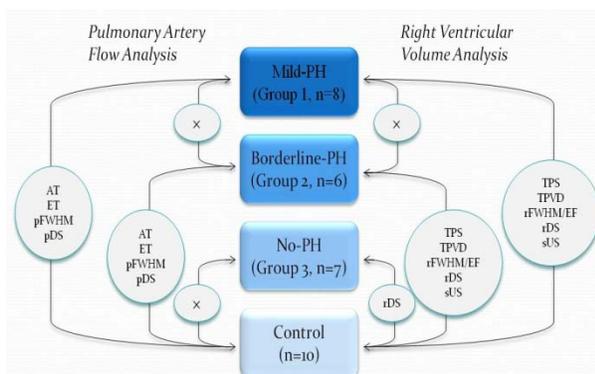


Figure 2 Patient Subgroups Pre-HSCT according to various stages of PH and Control Group; Boxes show RV volume and PA parameters which are significantly different between groups.

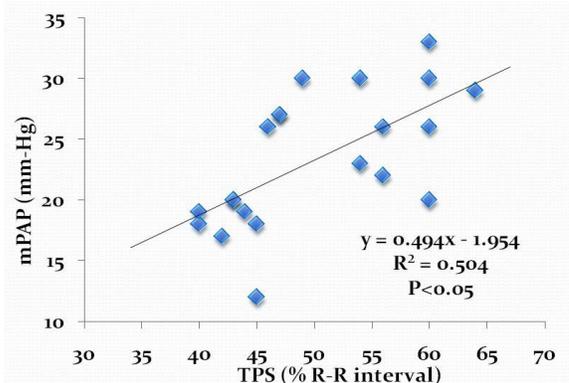


Figure 4 Scatter plot graphs show direct correlation between time to peak systole (TPS) and mPAP.