

II. High Variability in Peak Signal Intensity during CMRI First Pass Perfusion Imaging when a Standard Dose of Contrast Agent is Used - Blood Pool & Myocardium.

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Introduction and Aim

Cardiac magnetic resonance (CMR) first-pass perfusion imaging (FPPI) plays a central role in the diagnosis, clinical management and prognosis of patients with known or suspected ischemic heart disease. Previous work (*Poster I) highlighted that contrast agent dose/kg, ejection fraction (EF) and heart rate (HR) did not correlate with the variability in peak signal intensity in the blood pool of the left ventricle (LV) during first pass perfusion imaging. In addition to this, the contrast agent dose/Kg did not impact on the 'time to transit' of the bolus from the right atrium (RA) to the LV of the heart and on the arrival time of the bolus in the blood pool of the LV. This study sought to enhance these findings by investigating if contrast agent dose/kg, BMI, HR, EF, LV mass (LVM), and signal intensity in the blood pool of the LV during FPPI impact on the peak signal intensity detected in the myocardium during initial enhancement in a cohort of normal healthy volunteer (NHV) and a cohort of cardiac patients** (CP).

Method and Materials

Thirty eight volunteers: 19 males (M), mean age and (50: 14-78) years and 19 females (F), mean age and range (52: 16-78) years were sub-divided into two cohorts: those considered NHV post CMRI (n=12) and those considered CP after CMRI (n=26). All volunteers were imaged at 1.5T (Avanto, Siemens Medical Solutions, Erlangen, Germany) using a 2D single-shot gradient echo technique (Turbo-FLASH) to track a bolus (20ml) of contrast agent (Gadoteric Acid, Guerbet) as it passed through the cardiac chambers and myocardium of the left ventricle. Imaging parameters included: TR/TE (2.4/1.01)ms, FA = 10°, slice thickness = 6mm, matrix = 173x256 and average FOV = 140x171m. Image analysis was carried out on a Siemens multi-modality work station using ARGUS software (version VB15). An experienced segmenter performed semi-automated placement of endocardial and epicardial borders on the mid-ventricular short-axis slice of each volunteer (Figure 1).

Results and Discussion

The peak signal intensity in the myocardium during first pass perfusion did not correlate with the patient or volunteer's heart rate, ejection fraction, LV mass or body mass index.

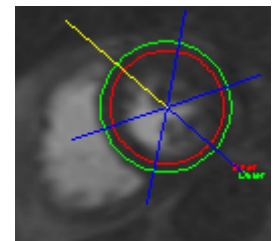
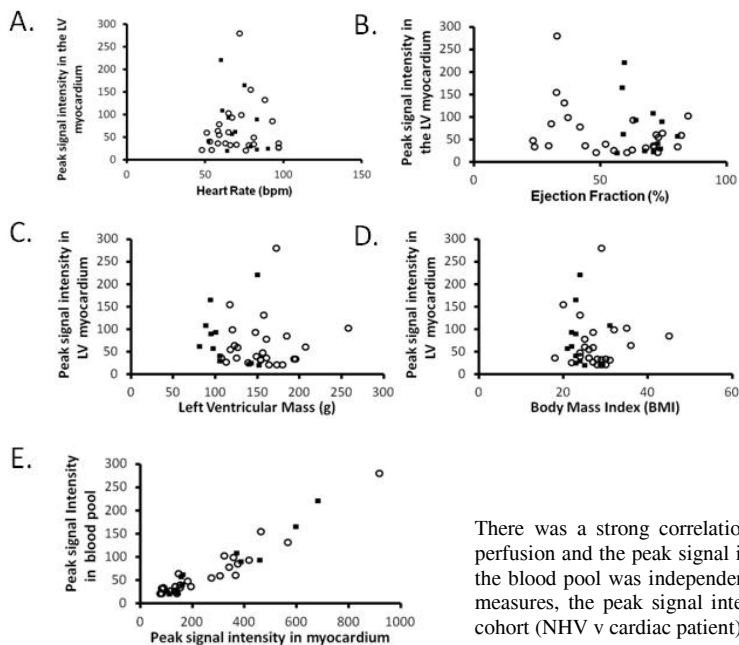


Figure 1: Epicardial and endocardial borders were placed on all mid-ventricular short-axis perfusion images

Conclusion

Peak signal intensity in the myocardium during initial enhancement correlates strongly with peak signal intensity in the blood pool during first pass. It does not correlate with cohort, HR, EF, LVM or the dose/Kg of contrast agent. The high variability in myocardial signal intensity in the rest perfusion phase of a stress/rest perfusion needs to be recognised in the interpretation of stress/rest perfusion examinations. It does not appear possible to control for this variability on the basis of LV parameters alone.

References

* I: High Variability in Signal Intensity and Contrast Dynamics during CMRI First Pass Perfusion Imaging when a Standard Dose of Contrast Agent is Used - Transit Times of Bolus & Peak Signal Intensity in the Blood Pool.

**The Cardiac patient cohort included individuals with LV hypokinesis, LV dilation, atrial/septal defects, (>50% - full wall) delayed enhancement, right ventricular (RV) and LV heart failure.