Dual Manganese- and Gadolinium-Enhanced Cardiac MRI Delineates the Peri-Infarct Region in Patients with Severe Ischemic Cardiomyopathy

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Introduction:
Delayed Gadolinium (Gd) Enhancement MRI (DEMRI) overestimates infarct size. Manganese enters only live, active cells, and its T1 signal is specific to live cardiomyocytes. We combined DEMRI and Manganese-enhanced MRI (MEMRI) in humans with ischemic cardiomyopathy to test if MEMRI provides unique infarct characterization.

Methods:
5 patients with ejection fraction (EF) <45%, Class I-III ischemic CHF, were enrolled (5 male, age 63±3 years). 2 cardiac MRIs (Signa 3THDx, 8-channel cardiac coil, GE HealthCare) were done for left ventricular (LV) function & DEMRI (day 0) and MEMRI (day 7). DEMRI: 10-20min after 0.2 mmol/kg intravenous Gd (Magnevist, Bayer HealthCare, Germany). MEMRI: 20-40min after 1mmol/kg intravenous SeeMore™ manganese (Eagle Vision Pharmaceutical Corp). Image analysis: (CMR42, Circle CV Imaging Inc) LV volumes traced semi-automatically; infarct volumes obtained using >3 standard deviations (SDs) above mean (DEMRI) and >2 SDs below mean (MEMRI signal defect = scar). % Infarct to total LV mass was calculated.

Results:
The average LVEF was 32±4%. The percentage of LV volume of the enhanced volume on DEMRI (39±11%) was significantly (p<0.01) greater than defected volume on MEMRI (16±3%) in all patients. The SNR of the border zone, the heterogeneously-enhanced regions on the periphery of the DEMRI signal and MEMRI defect areas, trends lower than the SNR of the core zone of DEMRI, and was significantly lower than the remote zone of the MEMRI defect (n=7 matched slices of DEMRI and MEMRI in 5 patients; Figure 1).

Discussion:
Non-viable myocardium volume, appearing as MEMRI defect, was significantly smaller than the injured volume by DEMRI enhancement. Concurrent use of DEMRI and MEMRI dual-contrast may thereby delineate the peri-infarct region, or “area-at-risk”. Further studies on the ability of this dual contrast approach to delineate area-at-risk and to predict viability and outcomes from revascularization are necessary.