Poster Abstracts: Clinical MRS

201. Relation of Absolute Concentrations of Cardiac High-Energy Phosphate Metabolites ATP and Phosphocreatine in Heart Failure to Clinical Severity

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Introduction: Cardiac high-energy phosphate (HEP) metabolism is impaired in failing human myocardium, and this may contribute to contractile dysfunction. 31P-MR spectroscopy (MRS) is the only technique for non-invasive measurement of cardiac HEP. Phosphocreatine-to-ATP (PCr/ATP) ratios are reduced in dilated cardiomyopathy (DCM) and in aortic stenosis (AS).

Purpose: We recently reported on the first measurements of absolute concentrations of PCr and ATP in these patients and showed that PCr/ATP ratios underestimate the true extent of changes in HEP, since ratios cannot detect simultaneous decreases of PCr and ATP. Our hypothesis now was that in heart failure, absolute levels of HEP correlate more closely with functional and clinical parameters than PCr/ATP ratios.

Methods: 4 age-matched groups (n = 10 each) were studied: Volunteers (VOL), severe hypertension (HYP), aortic stenosis (AST; valve area <0.7 cm2) and dilated cardiomyopathy (EF < 40%). Patients were graded according to NYHA, LV volumes and mass were determined by cine-MRI, and ATP, PCr and PCr/ATP ratios by 31P-SLOOP MRS.

Results: For NYHA classes 0 (VOL, HYP), II (7 AST, 1 DCM) and III (3 AST, 9 DCM), PCr (mmol/kg) were 8.38 ± 1.54, 6.78 ± 1.11*# and 4.23 ± 1.01*, ATP levels were 5.63 ± 1.04, 5.03 ± 0.81# and 3.58 ± 0.64*, and PCr/ATP ratios were 1.57 ± 0.34, 1.36 ± 0.22 and 1.21 ± 0.30*, respectively (*$p < 0.05$ NYHA II or III vs. NYHA 0, #$p < 0.05$ NYHA II vs. III). r and p values (r/p) for correlations are summarized in table 1.

Conclusion: Thus, PCr showed the highest, ATP intermediate and PCr/ATP ratios lowest correlations with clinical and functional variables. We conclude that absolute concentrations of HEP metabolites are more representative of the extent of energetic derangement in heart failure than PCr/ATP ratios.

Table 1

Correlations

	PCr	ATP	PCr/ATP
LV EF (%)	0.71/<0.0001	0.59/<0.0001	0.43/<0.05
LV EDV (ml)	−0.70/<0.0001	−0.56/<0.0001	−0.46/<0.05
LV mass (g)	−0.46/<0.05	−0.31/=0.05	−0.37/<0.05