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Meeting abstract

2098 Magnetic resonance imaging at 3 Tesla to quantify regional myocardial blood flow after myocardial infarction: comparison with ^{13}N-ammonia positron emission tomography and microspheres

Karl H Schuleri*, Kakuya Kitagawa, Riikka Lautamäki, Robert Evers, Frank M Bengel and Albert C Lardo

Address: Johns Hopkins University, Baltimore, MD, USA
* Corresponding author

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Background

Cardiac MR perfusion imaging is emerging as a powerful clinical tool. However, PET is currently considered a non-invasive gold standard for quantification of myocardial blood flow (MBF). Direct validation of 3T-perfusion MRI after myocardial infarction (MI) has not been reported.

Purpose

The purpose of this study was compare absolute MBF measurements from 3T-MRI, $^{13}NH_3$-ammonia PET, and microsphere after MI.

Methods

MI was induced in 5 minipigs by a 120-min occlusion of the LAD followed by reperfusion. PET and 3T-MRI studies were performed on the same day 1 or 3 days post MI. Microspheres were injected directly after the MR perfusion acquisition. First pass contrast enhanced myocardial MR images were obtained at rest after a 0.05 mmol/kg BW Gd-injection with a FLASH sequence on a 3 Tesla magnet (TIM Trio, Siemens Medical Solutions). Myocardial perfusion (ml/min/g) was quantified from arterial input and myocardial output function by using a Patlak plot analysis. From dynamic ^{13}N-ammonia PET studies, MBF was quantified by fitting to a validated 3-compartment model. Quantitative MBF measurements from 3T-MRI were compared to that of PET using a modified 17 segment AHA model. A total of 64 segments were evaluated. *Post mortem* the pig hearts were harvested and cut into 8 mm slices according to the short axis MRI prescription. Eight sectors per slice were used to compare matching microsphere flow measurements and MRI values.

Results

PET (Figure 1A) and MRI (Figure 1B) showed similar distribution of the infarct location in left ventricular polar plots.

Quantitative 3T-MRI MBF measurements showed a moderate correlation with percent uptake of ammonia ($R = 0.44$; $p < 0.0001$), and PET-derived absolute MBF($R = 0.46$; $p < 0.0001$) (Figure 1C). Bland-Altman Analysis of PET and MRI absolute MBF demonstrated a mean difference -0.07 ml/min/g with confidence limits of 0.59 and 0.73 ml/min/g for PET and MRI, respectively. Quantitative 3T-MRI MBF measurements showed a better correlation with radioactive microsphere measurements ($R = 0.54$; $p = 0.004$).

Conclusion

Quantitative two-compartment analysis of myocardial perfusion MRI using a Patlak plot approach provides an accurate assessment of absolute regional MBF at rest post MI. Further evaluation over a wider range of flow, including high stress flow is warranted.

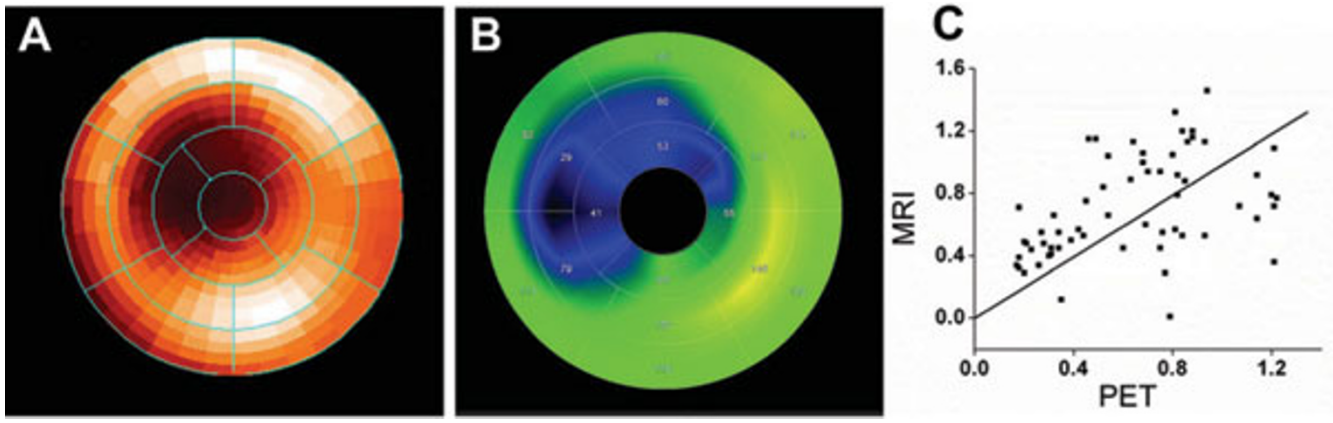

Figure 1
Quantitative two-compartment analysis of myocardial perfusion MRI using a Patlak plot approach can provide an accurate assessment of absolute regional MBF at rest in the setting subacute MI compared to 13NH3 PET techniques and microsphere measurements.