

Correlation of IVIM Diffusion Parameters to DCE-MRI Perfusion Parameters from a Three-Compartment Model in the Kidney

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Objective: To correlate intravoxel, incoherent motion (IVIM) parameters to dynamic contrast-enhanced (DCE-MRI) parameters in the renal parenchyma.

Methods: Thirty patients (M/F 20/10, age 58±7y) underwent abdominal MRI at 1.5T, including a coronal respiratory-triggered IVIM-DWI sequence with 16 b-values and a 3D-FLASH DCE-MRI acquisition (mean temporal resolution 2.7 sec) after injection of Gd-BOPTA. Mean diffusion signal in the renal cortex and medulla was fitted to the IVIM model to obtain true diffusion coefficient (D), pseudodiffusion coefficient (D*) and perfusion fraction (PF). Apparent diffusion coefficient (ADC) was also calculated using all b-values. GFR, cortical and medullary renal plasma flow (RPF), as well as mean transit times (MTT) for arterial and tubular compartments and whole kidney, were calculated from DCE-MRI signal by fitting to a three-compartment model. eGFR was calculated from serum creatinine measured 30±27 days of MRI.

Results: ADC/PF/RPF were significantly higher in the cortex compared to medulla ($p < 10^{-6}$). DCE-MRI GFR was significantly correlated with, but under-estimated serum eGFR (Spearman's $r/p=0.49/0.01$; slope/ $p=0.44/0.002$; intercept/ $p=13.12/0.245$). DCE-MRI GFR showed weak correlations with D and ADC in the cortex (D: $r/p=0.3/0.03$, ADC: $r/p=0.28/0.04$) and medulla (D: $r/p=0.27/0.05$, ADC: $r/p=0.34/0.01$). In addition, a significant weak correlation was observed between each of cortical and medullary PF ($r/p=0.32/10^{-3}$) and ADC ($r/p=0.29/0.003$) with RPF (**Fig.1**). Significant negative correlation was observed between MTT in the arterial compartment and cortical D* ($r/p=-0.38/0.004$) and D*x PF ($r/p=-0.34/0.01$).

Conclusion: We observed moderate correlations between renal IVIM and DCE-MRI parameters describing vascular perfusion, which suggests that the techniques provide complementary information on renal function.

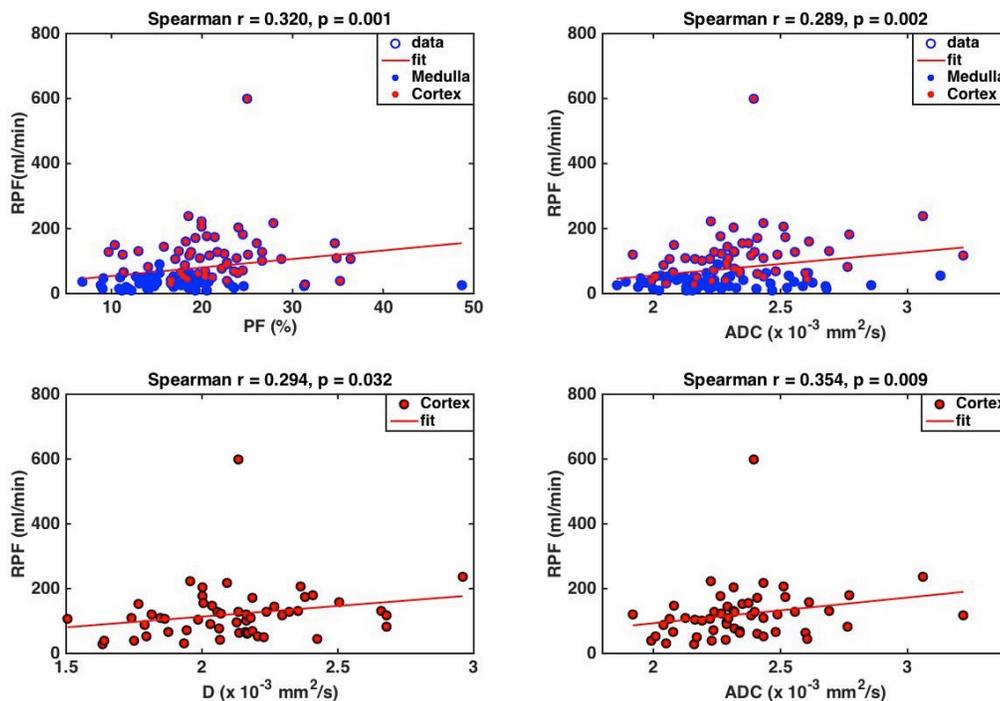


Fig.1. Renal IVIM parameters perfusion fraction (PF) and apparent diffusion coefficient (ADC) correlate with renal plasma flow (RPF) for pooled cortical and medullary data (**top**). Cortical RPF is significantly correlated with true diffusion coefficient D and ADC, but not with PF.