**INTRODUCTION**

While 3D contrast-enhanced MRA methods have demonstrated improved anatomic imaging of the renal arteries, the assessment of functional significance of a stenosis remains an important goal (1-3). One potential method for determining the functional significance of a renal artery stenosis is to measure the total renal blood flow using phase-contrast techniques.

The objective of this work is to 1) determine if renal blood flow is reduced in patients with significant (>50%) stenosis, 2) determine if flow increases following revascularization, and 3) assess whether abnormal flow indices predict patient outcome following revascularization.

**MATERIALS AND METHODS**

We performed a retrospective review of MRA, flow measurements, and medical records of 213 patients who underwent renal MRA for suspected renal artery disease. A significant stenosis was defined as >50% narrowing of the lumen identified on a 3D contrast-enhanced MRA exam. (Tr/Te/Flip = 8/1.8/45, Matrix 512 x 192 x 48, FOV 360 x 270 x 96 mm).

Renal blood flow (RBF) measurements were made using a breath-hold segmented phase contrast acquisition (Tr/Te/Flip = 19/4.9/45, Matrix 256 x 128, FOV 200 x 100 x 5 mm, VENC=100 cm/s). The renal mass was estimated by performing a delayed post-contrast 3D acquisition, and segmenting the renal parenchymal volume based upon a user defined threshold. The flow volume index (FVI in ml/min/cc renal tissue) was calculated by dividing the renal blood flow by the renal parenchymal volume.

The medical records of all patients were reviewed to determine whether a revascularization procedure was performed, and to tabulate patient outcome following the surgery. A beneficial outcome was defined as a reduction in post-procedure serum creatinine measurement (>0.2 mg/dl) or blood pressure (>15 mmHg) or a reduction in the number of blood pressure medications. The statistical significance of differences between flow measurements was assessed using a paired t-test.

**RESULTS AND DISCUSSION**

Ten patients with unilateral (>50%) renal artery stenosis had satisfactory flow and volume measurements. The mean flow in the stenotic renal artery (211±38 ml/min) was less than the contralateral nonstenotic renal artery (344±62 ml/min) (p< 0.05). However, the FVI in the stenotic renal artery (2.37±0.43 ml/min/cc) was not significantly different than the nonstenotic artery (2.89±0.5 ml/min/cc) (p=0.195). The latter phenomena was due in part to elevated FVI’s in patients with renal artery stenosis in vessels supplying small kidneys.

Seven patients had flow measurements performed immediately prior to and following revascularization. Mean flow in the effected renal artery increased following revascularization (pre RBF=151±42 ml/min. vs. post RBF=279±50 ml/min, p<0.05). The mean FVI’s were also increased following revascularization (pre FVI=0.97±0.11 ml/min/cc vs. post FVI=1.96±0.34 ml/min/cc, p<0.05). This fact suggests that the increase in renal blood flow outweighed the increase in renal volume following revascularization.

Mean flows in the renal arteries of patients who improved following revascularization did not differ from the mean flow in patients who showed no improvement after revascularization (Mean Flow_{improved}=274±68 ml/min vs Mean Flow_{unchanged}=271±58 ml/min, p=0.49).

While the FVI’s in the renal arteries of patients that demonstrated clinical improvement tended to be lower than FVI’s in those patients that demonstrated no improvement following revascularization, the difference was not statistically significant. (FVI_{improved}=1.78±0.33 ml/min/cc vs. FVI_{unchanged}=2.62±0.74 ml/min/cc, p<0.165)

**CONCLUSION**

Renal blood flow and FVI are decreased in renal arteries affected with stenosis when compared to the contralateral normal vessel, and they both increase following revascularization. However, neither parameter predicted a beneficial clinical outcome in this population of patients. These findings may in part be due to the small sample size of patients with adequate follow up data, heterogeneity of the patient population, and comorbid factors.

**REFERENCES**