Poster #: 44

Title of Abstract: **4D flow MR renography: a non-invasive technique for evaluation of renal arterial vasculature with application to renal transplant imaging.**

Institution: St Lukes Roosevelt Hospital

Authors: Zhang YC, M.D., Starc MT, M.D. Maccarrone V, M.D.

Modality: MR

Organ System: GU

Intro: N/A

Purpose: N/A

Methods Used: N/A

Results of Abstract: N/A

Discussion: N/A

Scientific and/or Clinical Significance? N/A

Relationship to existing work N/A

Purpose: To present a literature review of 4D flow MR renography as an emerging imaging tool to measure the temporal evolution of complex blood flow patterns in renal arterial vasculature. Methodological improvements such as accelerated acquisition, cardiac gating, and respiratory controls are introduced with a discussion of clinical application to renal transplants. Content Organization: Successful renal transplantation extends life expectancy and quality of patients with chronic kidney disease. Preoperative evaluation of renal vasculature has become increasingly significant given its impact on surgical outcomes such as blood loss, warm ischemia time, and ureteral complications. 4D flow MR renography characterizes renal blood flow in potential donor kidneys using hemodynamic parameters of velocity, wall shear stress. Follow-up 4D imaging of blood flow in transplanted kidneys may offer important information on transplant prognosis. In the last few years, scan times for 4D flow MR have been dramatically reduced using a radial undersampling method that preserves high spatial resolution and volumetric coverage. In contrast to traditional Cartesian sampling, data points in k-space are recorded in a radial trajectory, which provides a spherical imaging volume where fewer radial lines can be acquired without compromise of spatial resolution. Radial sampling technique has demonstrated strong repeatability and internal consistency in imaging of the suprarenal aorta, infrarenal aorta, and renal arteries in 10 healthy volunteers ($p=0.39$). Since passage of contrast in 4D flow MR renography is on the order of minutes, over multiple breathing cycles, dynamic imaging is affected by respiratory motion producing ghosting artifacts. Fortunately, an automated analysis correcting both rotational and translational motion in 3D across a breathing cycle has demonstrated an average refined translation error of less than half a voxel, and an average rotational error within one degree. Therefore, 4D flow MR renography is fast becoming a clinically feasible method for evaluation of vascular flow, with applications to renal transplant surgery. Major Teaching Points: 4D flow MR renography is a non-invasive technique for evaluation of complex blood flow patterns in renal arterial vasculature. Radial undersampling, cardiac gating, and automated rotational and translational correction for respiratory motion have delivered 4D flow MR closer to a clinically feasible imaging modality.