

# Assessing Renal Perfusion in Native and Transplanted Kidneys Using Arterial Spin Labeling MRI

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The number of patients with chronic kidney disease (CKD) that ultimately progress to a state of renal failure has doubled in each of the last two decades, reaching 527,000 by 2007. For these patients, transplantation remains the treatment of choice. Transplanted kidneys require continual assessment but, unfortunately, the standard diagnostic tools are insensitive to functional change and/or invasive. Although renal perfusion is not routinely measured in the clinical setting today, the literature suggesting its clinical utility is continually expanding. The first goal of this project was to implement an Arterial Spin Labeling (ASL) MRI kidney perfusion technique at this institution. Gadolinium-based MRI contrast agents were recently associated with Nephrogenic Systemic Fibrosis (NSF) in patients with renal failure, which has motivated research using non-contrast, ASL-MRI perfusion methods. Once the image acquisition and processing tools were in place, this perfusion technique was optimized and extended from healthy volunteers to subjects with poor renal function, and, ultimately, to patients with transplanted kidneys. This work demonstrated the feasibility of this ASL method in the clinical setting, examines its precision through a human reproducibility study, and assessed the accuracy of the technique using an animal study comparing ASL perfusion measurements to microspheres, the gold-standard. The research in this dissertation provided the foundation necessary to use this ASL perfusion technique in two clinical studies at this institution, which will examine its diagnostic potential for identification and characterization of acute and chronic allograft rejection.