# Assessing Kidney Perfusion using Arterial Spin Labeling and Radial Acquisition for Rapid Characterization of Inflow Dynamics

**N. S. Artz[1], K. Johnson[1], Y. Huang[1], E. A. Sadowski[2], and S. B. Fain[1,2]**
[1]Medical Physics, University of Wisconsin-Madison, Madison, WI, United States, [2]Radiology, University of Wisconsin-Madison, Madison, WI, United States

**INTRODUCTION:** Quantifying arterial spin labeling (ASL) perfusion measurements using data acquired at only one delay time requires assumptions for quantification that may be invalid [1]. Acquiring data at multiple delay times would reduce these assumptions and be more appropriate for diseased kidneys which may have delayed arrival time due to slower flow as well as regional differences in arrival time. The purpose of this study was to demonstrate the feasibility of efficiently acquiring data at multiple delay times using a radial approach.

**MATERIALS AND METHODS:**

**Radial Acquisition:** ASL-FAIR (flow-sensitive alternating inversion recovery) was performed in a healthy volunteer in a 1.5 T MR scanner. From 0.2 to 2 seconds following inversion (hyperbolic secant), a 2D radial balanced SSFP readout acquired unique projections with the following parameters: TR/TE/flip = 3.7/1.85ms/30°, BW = 125 kHz, FOV = 36 cm, and 128 x 128 matrix, slice orientation = oblique-coronal, slice thickness = 8 mm. Off-resonance spins near the banding frequencies were saturated just prior to readout which commenced at 0.2 seconds corresponding to the null-time for fat. Control (non-selective inversion) and tag (selective inversion) were alternated until 55 pairs were acquired in 11 minutes. The unique radial lines from all related inversions were combined and partitioned into twenty different delay time images, each with a temporal window of 100 ms and ~1200 projections.

**Cartesian Acquisition:** For comparison, a cartesian ASL-FAIR method was performed in a different healthy volunteer at a single delay time of 1.2 sec. Thirty-two control-tag pairs were acquired in six minutes using a balanced SSFP readout: TR/TE/flip = 4.6/2.3ms/70°, BW = 83.33 kHz, FOV = 34 cm, and 128 x 128 matrix, slice thickness = 8 mm.

Difference images are determined by subtracting the control image from the tag image.

**RESULTS AND DISCUSSION:**

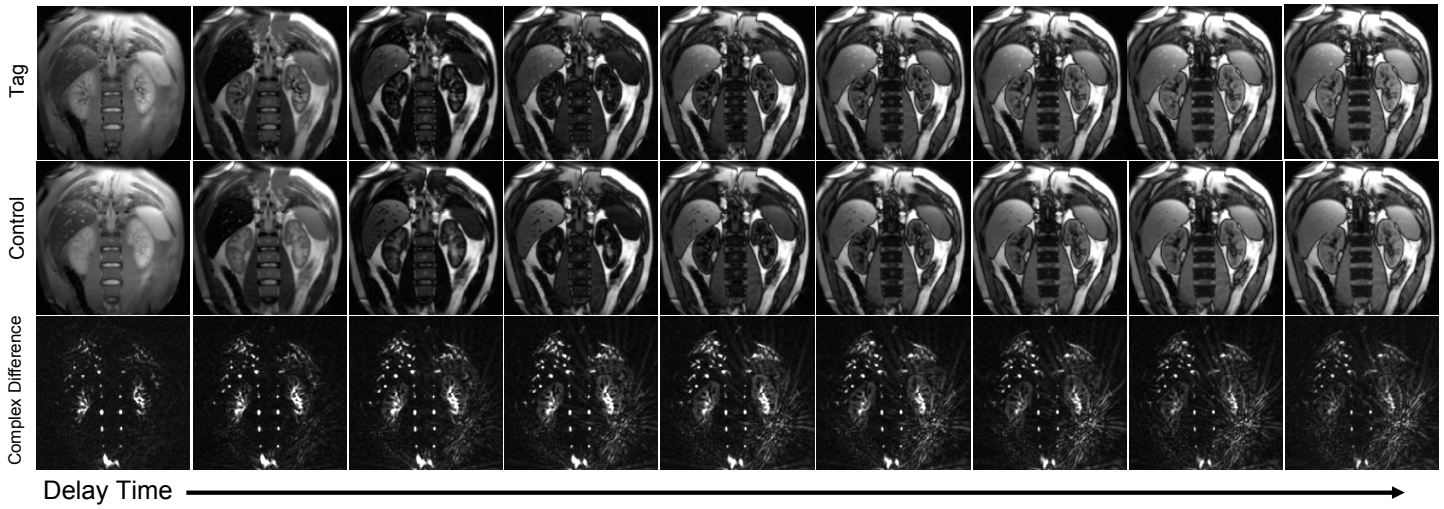


**Figure 1: Nine out of twenty delay time images are shown for the tag, control, and complex difference images acquired with the continuous radial acquisition from 0.2 seconds to 2 seconds following inversion.**

The perfusion-weighted difference images acquired with the radial acquisition (**Fig 1**) clearly demonstrate the perfusion at multiple delay times. The control and tag images show reasonable image clarity, however the complex difference images reveal streaking originating from below the left kidney (right side). Because each delay time image is fully sampled, this streaking is likely due to data inconsistency from the projections acquired over multiple breath cycles. Doing a magnitude subtraction mitigates the streaking slightly and a magnitude subtraction at a delay time of 1.2 seconds appears more comparable to the Cartesian difference image. (**Fig 2**)

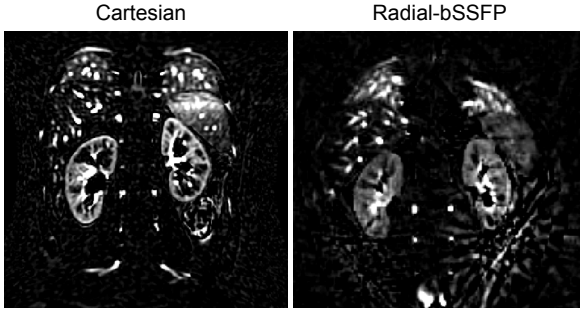


**Figure 2: Perfusion-weighted difference images (magnitude subtraction) in two different healthy volunteers acquired at a delay time of 1.2 seconds.**

**CONCLUSIONS:** Preliminary results suggest that a radial approach may efficiently acquire perfusion data at multiple delay times in a clinically feasible scan time. Future work will focus on reducing the streak artifact using motion compensation techniques and/or optimizing k-space trajectories. HYPR related reconstruction techniques will also be explored to improve SNR and further reduce scan time. **REFERENCES:** [1] [1]Parkes *et al*. Magn Reson Med. 2002; 48(1): 27-41.
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