

# Nonenhanced Renal MRA using Time-SLIP with 3D balanced SSFP: Optimization of Coronal Acquisition

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## PURPOSE

Recent association report of gadolinium contrast agents and Nephrogenic Systemic Fibrosis (NSF) diseases makes it increasing interests in using non-contrast MRA technique as an alternative [1]. Nonenhanced renal 3D MRA using time-spatial labeling inversion pulse (time-SLIP) with respiratory triggering has been optimized using the inflow technique in the axial acquisition [2,3]. However, the coverage of the axial acquisition is limited longer scan times and the inability to visualize other various vessels located outside the targeted coverage. In case of transplant patients, the axial acquisition is difficult to depict the transplanted kidney, which may be placed at the different position from the original. Furthermore, the longer black blood inversion travel time (BBTI), used for patients with slower blood flow, gives increased background signals, which deteriorates image quality. To overcome the coverage and the background signal problems, we have proposed a coronal acquisition using an optimized STIR pulse to saturate background and fat signals.

## MATERIALS and METHODS

All experiments were performed on 6 volunteers using a clinical 1.5-T system (Toshiba, Excelart Vantage ZGV powered by ATLAS), equipped with a parallel imaging ATLAS body coil. The time-SLIP pulse was placed in the coronal direction, where the blood flow of aorta flows directly into the renal arteries and descending aorta. For venous suppression, an inferior sat-band pulse was applied. First, optimization of the STIR pulse was studied in the coronal acquisition using the STIR pulse with TI of 124, 190, and 300 ms using the BBTI of 1500 ms. Next, the BBTI was varied using 1100, 1300, 1500, and 1700 ms with an optimized STIR TI time. Finally, the optimized coronal technique was compared with the conventional axial acquisition using a CHESS fat suppression technique. Typical wide coronal acquisition parameters for the non-contrast renal MRA were as follows; TR/TE=4.3/2.2 ms, FA= 120 deg., matrix=256x256(interpolated to 512x512), thirty 3-mm section slices (interpolated to sixty 1.5-mm slices), resolution of 0.65x0.65/1.5 mm (after interpolation), respiratory triggering, parallel reduction factor=2.0, time-SLIP tag slice thickness=300-350 mm, 2 segmentations, STIR, and a total scan time of about 3 min, depending upon the respiratory cycle.

## RESULTS

Comparison of STIR times of 124, 190, and 300 ms, the STIR of 190 ms gives good suppression of background as well as fat saturation. After determining the STIR time of 190 ms, the BBTI was varied in 1100, 1300, 1500, 1700 ms, and the BBTI of 1500 ms provided good contrast in the coronal acquisition; whereas, the previous study of the axial scan gives suitable contrast at BBTI of 1100 ms [2]. Figure 1a shows the contrast ratio of the renal artery vs. the medulla and Fig.1b shows the contrast of the renal artery vs. the cortex using the conventional axial acquisition and the new coronal acquisition among 6 volunteers. After optimization of the parameters, the coronal time-SLIP acquisition with the STIR technique was compared with the axial acquisition with the CHESS technique. Figure 2 show the coronal MIP images obtained using the axial and coronal acquisitions. Both images present good contrast between the renal arteries and the background without overlap of the renal veins. Note that the coronal acquisition shows a large coronal coverage showing the splenic artery and the iliac bifurcation outside the targeted area of the axial acquisition. Similar results were obtained in other 5 volunteers.

## DISCUSSION

The coronal acquisition time-SLIP using the STIR pulse provides superb renal MRA images on volunteers. The merits of the new technique provide a large coronal coverage, uniform background and fat saturation, ability to extend the longer BBTI for slow flow, and possibility for scan time reduction. The technique is promising; however, further clinical evaluation is required.

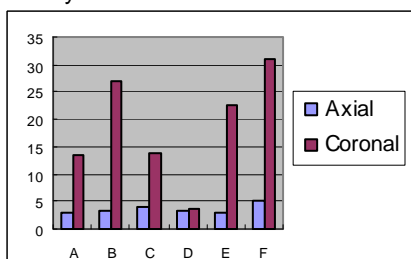


Fig. 1a) Contrast of the renal artery vs. the medulla

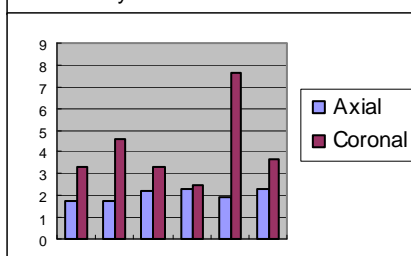


Fig. 1b) Contrast of the renal artery vs. the cortex

REFERENCES: 1] Miyazaki M, Lee VS. Radiology, 248:20-42; 2008. 2] Takahashi J, et al, ISMRM p179, 2007. 3] Takahashi J, et al, ISMRM p2903, 2008.

Fig. 1a) Contrast of the renal artery vs. medulla, and 2b) the renal artery vs. cortex for the axial and coronal acquisitions in 6 volunteers.

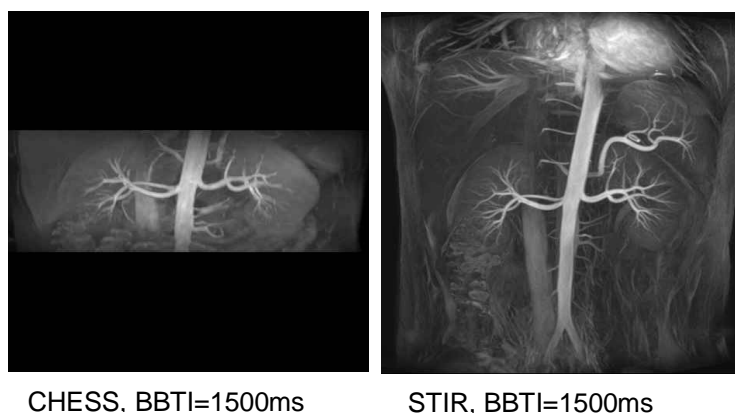


Fig. 2. Coronal MIP images of the axial (left) and coronal (right) acquisitions.