Depiction of Transplant renal Vascular anatomy and complications: Unenhanced MR Angiography by Using Spatial Labeling with Multiple Inversion Pulses

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Purpose: To evaluate the ability to depict anatomy and complications of renal vascular transplant with unenhanced magnetic resonance (MR) angiography with spatial labeling with multiple inversion pulses (SLEEK) and to compare the results with color Doppler (CD) ultrasonography (US), digital subtraction angiography (DSA), and intraoperative findings.

Introduction: Unenhanced MR angiography with spatial labeling with multiple inversion pulses (SLEEK) sequence **(Fig. 1)** has made substantial progress and is effectively used for visualization of renal arterial stenosis and fibromuscular dysplasia [1]. Although SLEEK and routine inflow inversion recovery renal MR angiography [2]were basically the same on the principle of imaging, SLEEK technique is used to highlight the importance of the preparation of multiple space selective inversion recovery pulses, with which blood flow could be labeled in a more flexible way. The purpose of this prospective study was to evaluate the ability to depict the anatomy and complications of renal vascular transplant with unenhanced MR angiography by using SLEEK.
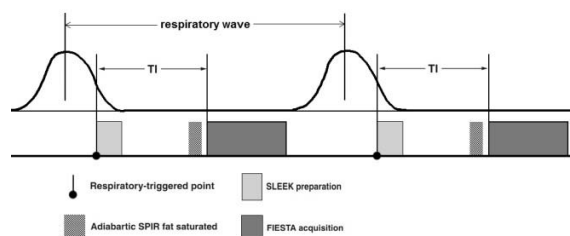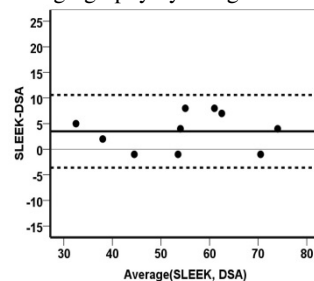

Figure 1: Diagram of SLEEK

Figure3: Bland-Altman plot shows a small systematic overestimation of the degree of stenosis with SLEEK.
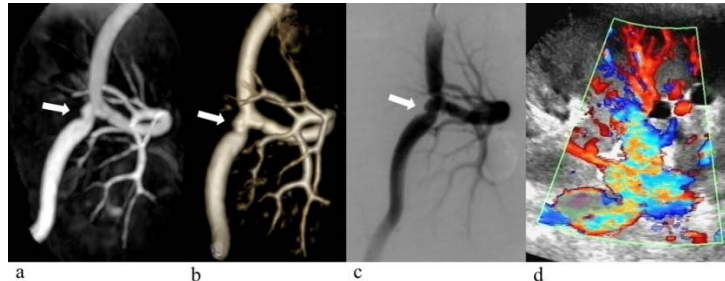

Figure2: a, b, MIP and VR from SLEEK show low-grade stenosis (grade 1) at the anastomosis with external iliac artery (arrow); c, DSA confirmed the low-grade stenosis (arrow). d, CD US scan shows stenosis.

Materials and Methods: This study was approved by the institutional review board, and written informed consent was received before examination. Seventy-five patients who underwent renal transplantation were examined with unenhanced MR angiography with SLEEK and CD US. DSA was performed in 15 patients. Surgery was performed in eight patients. The ability of SLEEK to show transplant renal vascular anatomy and complications was evaluated by two experienced radiologists who compared the results with CD US, DSA, and intraoperative findings.

Results: Patients successfully underwent SLEEK MR angiography. Transplant renal vascular anatomy was assessed in 87 arteries and 78 veins. Renal vascular complications from transplantation were diagnosed in 23 patients, which included 14 with arterial stenosis **(Fig. 2)**, three with arterial kinking, two with arteriovenous fistulas, two with venous stenosis, one with pseudoaneurysms, and one with fibromuscular dysplasia. Three patients had two renal transplants and nine patients had nine accessory renal arteries. More accessory renal arteries were detected with SLEEK than with CD US. Correlation was excellent between the stenosis degree with SLEEK and DSA (r= 0.96; P＜0.05) **(Fig. 3)**. For those with significant artery stenosis (＞50% narrowing) proved with DSA (n= 7) or surgery (n= 3), positive predictive value was 91% (10 of 11).

Discussion and conclusion: In this study, the preliminary data from our study demonstrate that SLEEK sequence was capable of displaying transplant renal vascular anatomy and complications. Our results show that consistantly high-quality images can be obtained by using SLEEK, which enabled visualization of even small branches within the transplant renal parenchyma and subtle accessory renal arteries. However, because the signal of the arteries depends on the cardiac output of the patient, a suboptimal blood-suppression TI may lead to poor signal-to-noise ratio and vessel depiction. We did not obtain an additional scout image, which may be helpful in evaluating the flow velocity in the aorta to optimize the blood-suppression TI; thus, a larger study for full comparative evaluation of diagnostic performance is necessary. In conclusion, unenhanced MR angiography with SLEEK preliminarily proved to be a reliable diagnostic method for depiction of anatomy and complications of renal vascular transplant. It may be used for evaluation of patients with renal transplant, and in particular for those with renal insufficiency.

Reference: [1] Pei Y et al. AJR. 2012;   [2] Rotem S. et al. Radiology. 2009.