Non Contrast MRA of Renal Transplant Vasculature Using 3D TrueFISP

N. Berg[1], J. J. Sheehan[1], X. Bi[2], P. J. Weale[2], R. Ramsay[1], R. Jerecic[2], and J. C. Carr[1]

[1]Radiology, Northwestern University, Chicago, IL, United States, [2]CMR Research and Development, Siemens Medical Solutions, Chicago, IL, United States

Introduction: Contrast enhanced Magnetic Resonance Angiography (CEMRA) is increasingly regarded as the gold standard for imaging the vasculature and is generally considered a safe alternative to CTA or conventional angiography in the assessment of the renal transplant patient. However, many renal transplant patients have impaired renal function, making gadolinium contrast administration unsuitable. Alternative non contrast imaging techniques are more desirable in this setting so that renal transplant arterial disease can still be evaluated using noninvasive methods such as MRI. In this small patient study, we investigate a novel non contrast MRA (NCMRA) technique using a 3D TrueFISP sequence with a selective inversion pulse to assess the renal vasculature in post-transplant patients.

Methods:

3 renal transplant recipients scheduled for CEMRA underwent the 3D True FISP protocol in addition to conventional clinical CEMRA. The experimental protocol was performed prior to contrast imaging in all cases. All MR studies were performed on a 1.5 T MRI scanner (Avanto, Siemens Medical Solutions, Erlangen, Germany).

Non-contrast renal MRA was performed using a navigator-gated, ECG-triggered 3D TrueFISP sequence. A slice-selective inversion slab was graphically planned to suppress signal from static tissues within the imaging volume [1,2] so that only inflowing blood during the inversion recovery time showed high signal intensity. TI ranged from 800 to 1200 msec aiming for adequate arterial blood inflow as well as effective background signal suppression. Imaging parameters include: TR/TE/FA = 3.8/1.9/90°. Acquired voxel size was 1.3×1.3×2.0 mm^3 and reconstructed to 72 slices with 0.65×0.65×1.0 mm^3 voxel size. Imaging time was approximately 2 minutes.

CEMRA images were acquired with a 3D fast gradient-recalled echo sequence and intravenous injection of 0.2 mmol/kg of Gd-DPTA within a breath-hold. Imaging parameters included: TR/TE/FA = 3.4/1.2/25°. 40 slightly tilted coronal slices were acquired and reconstructed into 80 slices with 1.0×0.74×1.5 mm^3 voxel size. Both non-contrast and contrast-enhanced acquisitions were accelerated with parallel imaging (GRAPPA) factor of 2 in the phase-encoding direction.

CEMRA and NCMRA images were reviewed by a radiologist and scored for image quality on a likert scale of 0-3, dividing the renal arteries into four segments. Quantitative evaluation was also performed to determine renal artery length and number of branch vessels visualized.

Results: On average, the NCMRA protocol showed equal or increased image quality as compared to the CEMRA protocol. The NCMRA protocol had better average scores in the most proximal and most distal segments of renal arteries. (Fig. 2) In the quantitative analysis, the average length of renal artery visualized was 7.1 cm with the NCMRA protocol and 5.8 cm with the CEMRA protocol. The average number of branch vessels visualized was 3.3 and 3.0 with noncontrast and contrast-enhanced protocols respectively.

Conclusion: Given the high incidence of vascular complications associated with renal transplant (1-15%) [3], safe imaging methods are needed for follow up in post-transplant patients. Compared with CEMRA, our technique demonstrates equivalent imaging of the post-transplant vasculature. This technique may be clinically advantageous for patients with renal impairment who are poor candidates for IV contrast administration. The NCMRA protocol examined in this study is a promising alternative NCMRA technique for assessing the vasculature in renal transplant patients. Further patient studies will follow to assess the clinical efficacy of the technique.

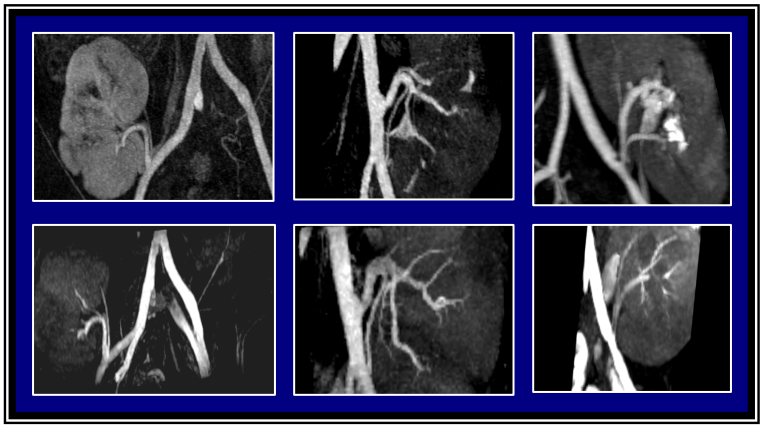

Figure 1 Contrast (top) and non-contrast MRA depicting three transplanted renal arteries – in general results are concordant – In the case on the right there is loss of signal in the proximal renal artery which may suggest turbulence or high velocity blood in the vessel distal to the anastamosis –CEMRA was suggestive of mild stenosis at the site of anastamosis.

Figure 2 Comparison of qualitative scoring for the segmental analysis of the three examined transplanted renal arteries. Increased scores in the distal segments for the noncontrast protocol may be a consequence of parenchymal enhancement with the contrast-enhanced approach

References:

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