

# Comparison of Subtractive and Non-Subtractive Nonenhanced MR Angiography for Peripheral Arterial Disease: A Pilot Study

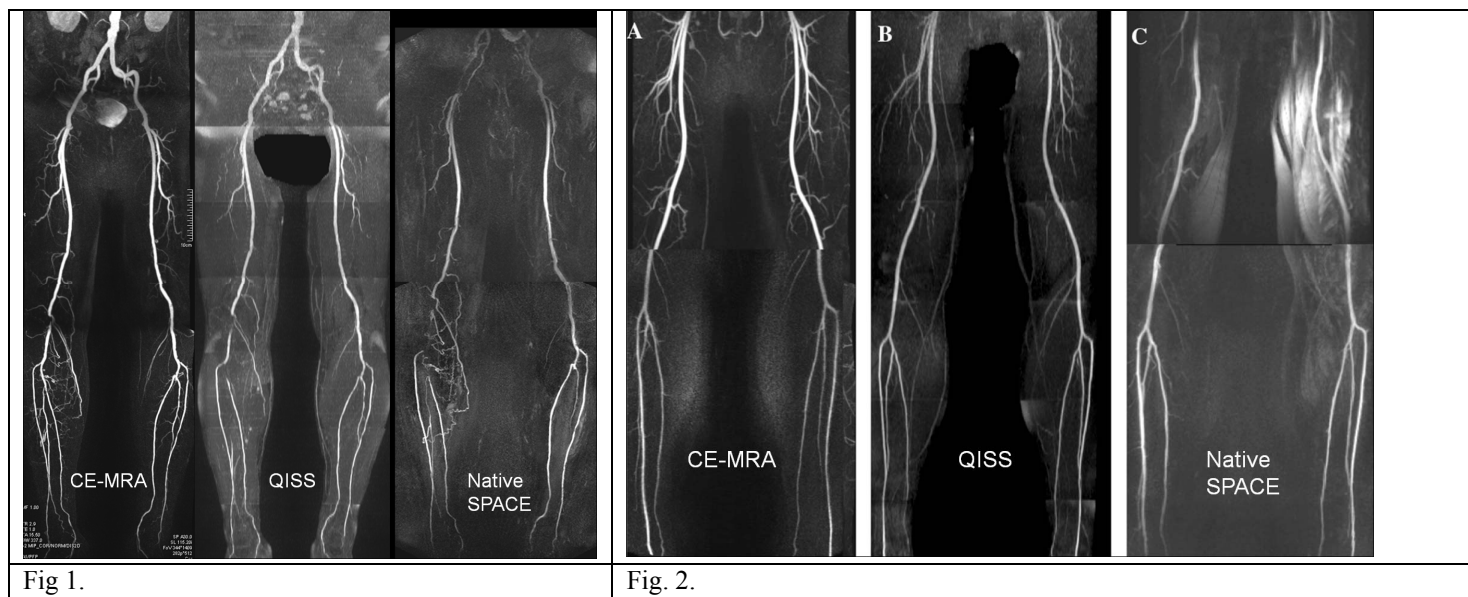
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**INTRODUCTION:** Patients with suspected peripheral arterial disease (PAD) often require imaging evaluation prior to percutaneous or surgical intervention. Given the increased incidence of impaired renal function in the PAD population, nonenhanced techniques can be a useful alternative to contrast-enhanced MRA (CE-MRA) for avoiding the risk of nephrogenic systemic fibrosis. Both subtractive and non-subtractive approaches have been proposed, each with potential advantages. The purpose of this pilot study was to determine the relative merits and accuracy of the two types of nonenhanced approaches, using CE-MRA as the reference standard.

**METHODS:** This study was approved by our institutional review board. Imaging was performed on a 1.5 T MRI system (Siemens MAGNETOM Avanto, Erlangen, Germany). Seventeen patients (mean age 68.8 years, 12 male) were studied. A total of 30 limbs, 90 regions, and 360 segments were evaluated. One segment was excluded due to a hip joint prosthesis and a second due to a femoral artery stent. The subtractive Native SPACE technique used an ECG-gated 3D single shot fast spin echo pulse sequence with pixel dimensions of 1.2mm-1.6mm and slice thickness of 1.4mm-1.7mm, coronal plane, grappa factor=2, 2 segments/3D partition. Timing of diastolic and systolic trigger delays was determined using 2D cine phase contrast. The non-subtractive QISS technique used fat-suppressed ECG-gated 2D single shot bSSFP, one slice per heartbeat, 0.8mm-1.0 mm in-plane resolution, axial slice thickness 1.2mm-3mm, grappa factor=2, 90 degree flip angle. For CE-MRA, a time-resolved TWIST MRA of the calf was performed, followed by a three-station stepping table MRA using a total of 0.2 mmol/kg Gd contrast agent,  $\leq 1.0$ mm in-plane resolution and slice thickness of 1.2mm-1.5mm. Two experienced radiologists performed blinded independent readings of the source images, thin and thick maximum intensity projections. Presence of a stenosis was graded using the 5-point ACR scale, image quality was rated using a 5-point Likert scale, and inter-observer variability measured using the kappa statistic.

**RESULTS:** Examples of patient data are shown in Figs. 1 and 2. For reader 1, the sensitivity/specificity for Native SPACE was 88.9%/80.0% and for QISS 91.1%/93.3%. For reader 2, the sensitivity/specificity for Native SPACE was 88.9%/82.2% and for QISS 93.3%/91.1%. There was excellent inter-observer agreement for all techniques ( $\kappa = 0.997$  for CEMRA,  $\kappa = 0.969$  for QISS,  $\kappa = 0.991$  for Native SPACE). Mean Likert scores were significantly higher for QISS ( $3.3 \pm 0.8$ ) versus Native SPACE ( $2.2 \pm 0.4$ ) ( $p < 0.05$ ).



**CONCLUSION:** Our data show good sensitivity and excellent inter-observer agreement for PAD using either subtractive or non-subtractive nonenhanced MRA. In this pilot study, specificity and image quality were significantly better for QISS, in part related to substantially reduced sensitivity to artifacts from patient motion and lack of dependence on selection of trigger delays.

**REFERENCES:** [1] Lim RP et al. JMRI 2008;28:181-9. [2] Edelman RR et al. Magn Reson in Med 2010; 63:951-8.

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