INTRODUCTION: We hypothesized that high undersampling factors could be used in conjunction with radial Quiescent-Inflow Single-Shot (QISS) MRA in order to accelerate the data collection and enable multi-slice and body coil acquisitions.

METHODS: The study was approved by the Institutional Review Board and used written, informed consent. Three healthy subjects and four patients with PAD were imaged on a 1.5T MRI system (Magnetom Avanto, Siemens Healthcare) using an eight station ECG-gated protocol. Cartesian QISS MRA was acquired as previously described (1). For single-slice radial QISS, 60-120 views were acquired with a matrix of 352 or 384 projections and 1-mm in-plane resolution. For dual slice radial imaging, 46 views were acquired with a matrix of 352 projections and 1-mm in-plane resolution. For triple slice radial imaging, 32 views were acquired with a matrix of 384 projections and 1.17-mm in-plane resolution. For multi-slice radial QISS, the concurrent slice acquisition order was foot to head. In two subjects, single-slice 60-view radial QISS MRA was acquired using just the body coil for signal reception using two signal averages and 1.3-mm in-plane resolution to compensate for the inherent SNR loss from not using phased array coils.

RESULTS: The mean (standard deviation) measurements for the intra-arterial signal-to-noise ratio were: Cartesian 1 slice - 29.3(5.5); Radial 1 slice, 92 views - 22.3(3.6); Radial 1 slice, 46 views - 18.5(2.0); Radial 2 slices, 46 views - 18.3(3.2); Radial 3 slices, 32 views - 21.7(3.9). Normalized for the larger pixel, the SNR for the 3-slice, 32 view acquisition was 15.8. Comparing Cartesian QISS (93 lines) with single slice radial QISS (92 views), the respective image quality scores were 2.6 ± 0.4 and 2.9 ± 0.2 (p = 0.04). Horizontal striping was present with multi-slice radial QISS MRA (especially with the 3-slice acquisition) but the image quality remained diagnostic.

DISCUSSION: We have demonstrated the feasibility of radial QISS MRA with much higher undersampling factors than are achievable using a Cartesian k-space trajectory and standard parallel imaging techniques. Using a three-slice acquisition (undersampling factor of 18.8), scan times of 2 minutes or less were obtained for coverage of the entire length of the peripheral arteries. Also, highly undersampled radial QISS can be acquired using a single-element body-coil receiver, not possible with Cartesian QISS and parallel imaging techniques.