

COMPARISON OF SWI AND DIR-PREPARED TSE FEMORAL ARTERY WALL IMAGING

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Introduction:

Conventional vessel wall imaging requires black blood techniques such as Double Inversion Recovery (DIR) or Saturation Band. These techniques, however, suffer from restricted anatomical coverage and suboptimal blood-suppressing performances at areas with slow or in-plane flow. Yang et al proposed the use of Susceptibility Weighted Imaging (SWI) as a flow-independent means to visualize peripheral artery wall [1]. Despite the benefits of SWI vessel wall imaging, namely blood flow independence, three dimensional coverage, and sensitivity to calcification, the accuracy of SWI in morphological measurement has yet to be addressed. Here we compared SWI with the reference method, single slice DIR turbo spin echo (TSE), on measuring femoral artery lumen and wall size.

Methods:

Data acquisition: 9 aged healthy volunteers (age 52.6 ± 5.8 years) participated in this study at 3.0T (Siemens Trio). Standard SWI product sequence was used with the following parameters: TR/TE = 26.0/15.6 ms, FOV = 186×230 mm², matrix = 260×320 , 32 slices, resolution = $0.72 \times 0.72 \times 2.0$ mm³, acquisition time = 4.1 min, flip angle = 15°, bandwidth = 80 Hz/pixel, transverse acquisition. FOV was placed approximately 1 cm below femoral bifurcation as identified by a time-of-flight scan. Three slices from the top, middle, and bottom of the SWI imaging volume in each volunteer were selected for additional single-slice T2-weighted DIR TSE with same FOV, resolution, and slice thickness. Other parameters were: TE=51-52 ms, TR= 4023 ms, flip angle=180°, 2 averages, acquisition time= 2.6 mins, bandwidth=260-270 Hz/pixel, spectrally selective fat saturation. ECG gating was not used according to literature [2].

Data analysis: On a workstation (Siemens Leonardo), lumen and wall contours

were manually drawn by an experienced researcher on matched SWI phase images and TSE images separately. Data were analyzed using Matlab. Three TSE images were discarded due to poor image quality. In total there were 23 DIR TSE images. Paired t-tests were performed at $\alpha=0.05$.

Results:

Representative images were shown in Fig. 1. Paired t-tests identified no significant difference between area measurements using these two methods in lumen ($p=0.719$) and wall ($p = 0.156$). Bland - Altman plots showed that TSE and SWI area measurements agree in both lumen and wall (Fig.2), and the agreement in wall was lower compared to lumen (note the data point outside the 1.96 SD confidence interval in Fig.2 B).

Discussions and Conclusions:

The agreement between lumen area measurements demonstrates that

the lumen-wall contrast in SWI phase image is enough to accurately delineate lumen-wall boundary. The relatively low agreement between wall area measurements could be explained by partial volume effect. In conclusion, morphological measurements using SWI phase images and DIR TSE images agree in femoral artery wall imaging. We suggest that SWI could be a promising flow-independent technique for vessel wall imaging.

References: [1] Yang et al. JMRI (2009); 30: 357-365. [2] Mani et al. JMRI (2005); 22: 628-633.

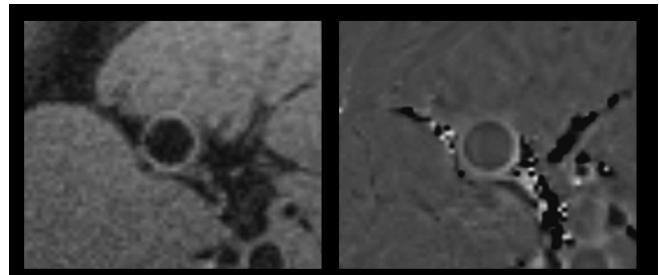


Figure 1. TSE (left) and SWI (right) images from one volunteer.

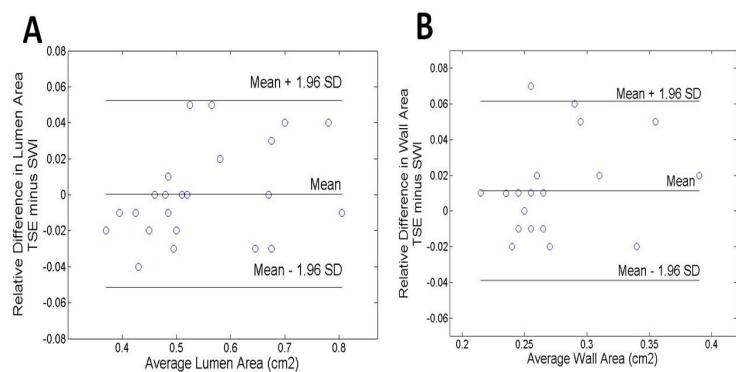


Figure 2. Bland-Altman plots for lumen (A) and wall (b) measurements.