Reproducibility Assessment of Flow Mediated Dilatation Induced Brachial Artery Area Change Using a Gated Segmented TrueFISP Technique

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INTRODUCTION

Endothelial function is an important factor in the pathogenesis of atherosclerosis, hypertension, diabetes and heart failure. Since mid 90s, high frequency echo imaging of the brachial artery (BA) has been used to evaluate endothelium-dependent flow-mediated vasodilatation (FMD). It has been shown that MRI can evaluate the BA reactivity to hyperemia more reliably than echo due to its capability to image at high spatial resolution at any plane. However, the conventional MR cine technique has limited SNR at high resolution. We hypothesized that we can improve measurement reproducibility with a gated segmented TrueFISP technique.

MATERIAL AND METHODS

Nine normal volunteers (3 females) ages: 25 to 83 (Mean and SD: 61.3±17.3) were enrolled with IRB approval and informed consent. Prior to participation, volunteer was asked to fast for at least 8 hours, excluding exercise, caffeine, smoking and high fat foods for 6 hours and withheld all vasoactive medications. The study was performed on a 1.5 T Siemens Sonata scanner (Siemens Medical Solutions, Malvern, PA) with a CP array small extremity coil (MRI Devices Corp., Waukesha, WI) using an ECG Triggered TrueFISP technique. After a baseline BA measurement, a blood pressure cuff on subject's forearm was inflated to 50mm of Hg above the systolic blood pressure for 5 minutes and then was rapidly deflated. Thirty seconds prior to cuff deflation, images of the BA will be taken and continue for three minutes thereafter. To ensure the accurate imaging of the BA, an in-plane BA image was first collected and the cross section BA image was prescript perpendicular to it. All imaging including the blood pressure cuff inflation and deflation procedure was repeated in one hour. Sequence parameters were as follows: TR/TE/FA = 2.9ms/1ms/65°, data matrix 245×384, field-of-view 80×110cm^2, number of segments 7, bandwidth per pixel 200Hz and voxel spatial resolution of 0.3×0.3×3mm^3, an acquisition window of 250ms at diastole, total imaging time for one measurement was about 15 seconds.

Contours of BA were manually drawn using MASS (Medis, Leiden, the Netherlands). The coefficient of variability (CV) was calculated as the SD of the difference of repeated measures divided by the mean measurement value.

RESULTS

An example of BA (arrows) image is shown in **Figure 1**, baseline BA on the left and BA at 1 minute after blood pressure cuff deflation on the right. The mean and SD of BA area measured were 18.4 ± 6.7 mm^2, the mean and SD of BA area increase of the 1st and 2nd measurement were D1=(10.67 ± 2.98) % and D2=(10.87 ± 2.93) %, respectively. The dilation variation between two experiments was defined as ABS(D1-D2)/MIN(D1,D2)*100, and its mean and SD were (11.0 ± 5.8)%. The mean and SD of CV were 0.073 ± 0.036.

CONCLUSION

The segmented TrueFISP sequence can be used to measure BA area change with a good reproducibility, improved over published result (CV=0.11)(1).

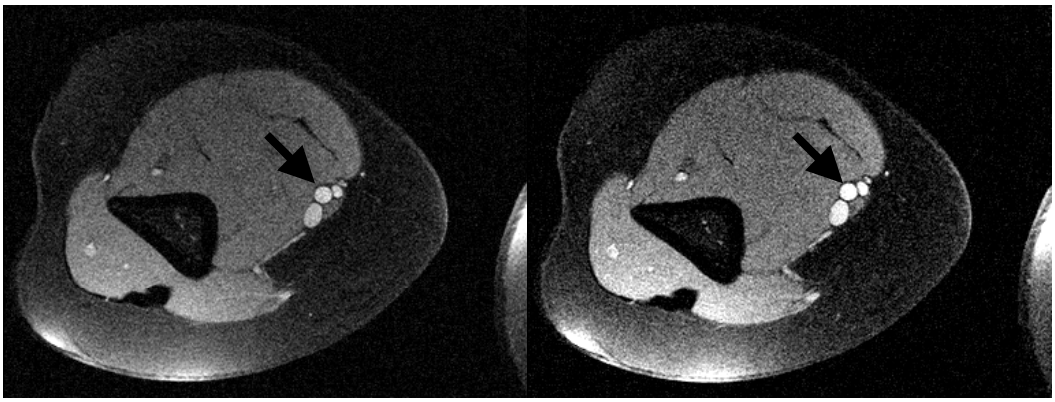

Figure 1. One example of BA (shown at arrow) images: baseline BA on the left and dilated BA at 1 minute after blood pressure cuff deflation

REFERENCE

(1). Sorensen MB, et al., Long-Term Use Of Contraceptive Depot Medroxypregesterone Acetate In Young Women Impairs Arterial Endothelial Function Assessed By Cardiovascular Magnetic Resonance, Circulation. 2002; 106 1646-1651.