NATIVE SPACE Angiography with MTC and Fat Saturation Pulses

A. Priatna[1], G. Foster[2], J. Xu[1], P. Weale[1], S. Love[2], and V. Narra[2]

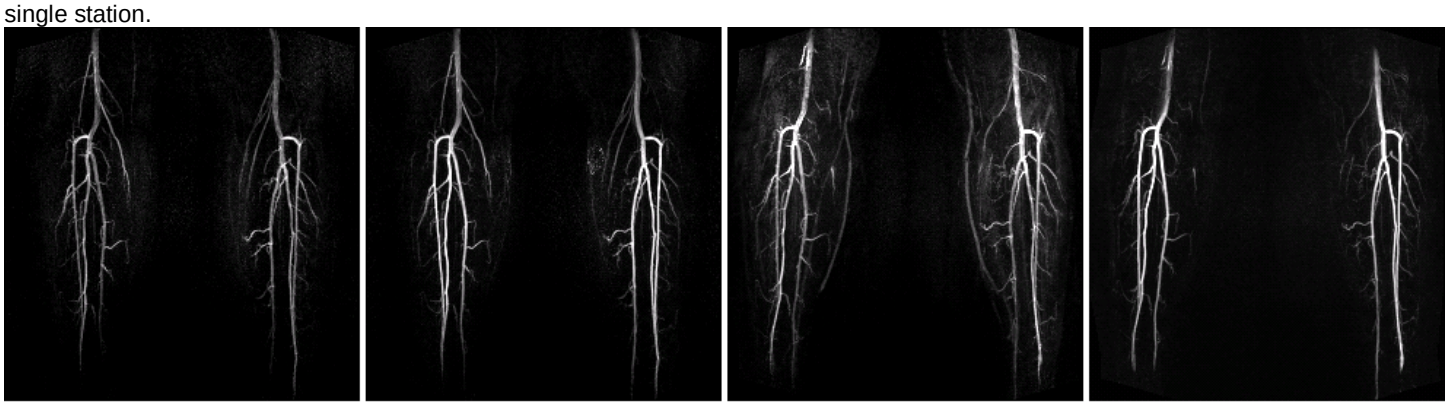
[1]R&D Collaborations, Siemens Medical Solutions USA, Malvern, PA, United States, [2]Mallinckrodt Institute of Radiology, Washington University School of Medicine, St Louis, MO, United States

Introduction

Non-contrast angiography emerges as an alternative method from contrast MRA due to the association of gadolinium based-agent with nephrogenic systemic fibrosis (NFS). A non-contrast MRA technique using gated 3D Turbo Spin Echo has been reported for various clinical applications [1][2]. Recently, a novel technique using triggered non-selective refocused 3D SPACE or called NATIVE SPACE (NATIVE = Non-contrast Angiography of the Arteries and Veins, SPACE = Sampling Perfection with Application Optimized Contrast by using different flip angle Evolution) was shown to improve spatial resolution and speed [3]. In this technique, triggered phase contrast flow measurements were performed to determine the peak and the minimal flow within the cardiac cycle. Images were subtracted from the SPACE acquisition during the period of high and slow flow. SPACE with its variable flip angle technique further helps achieve lower SAR and short TR which results in short total acquisition time. In this abstract, we propose to use magnetization transfer pulse and fat saturation pulses to help suppress the background tissue and fat signal to further improve the images of the vessels.

Method

Experiments were performed on 1.5T Avanto and 3T Tim Trio systems (Siemens Healthcare Sector, Erlangen, Germany) using the peripheral angiography coil. Phase contrast flow quantification with retrospective gating was used to determine the trigger time for the fast flow and the slow flow. For the non-contrast MRA, a gated 3D SPACE sequence with 25% spoil gradient readout was used with the following parameters: FOV = 440 mm, slice thickness =0.71 mm, partitions= 80, matrix = 246x256, TR =264 ms, TE = 18 ms, BW = 975 Hz/pixel, turbo factor = 49, echo train duration = 141 ms, ETS = 2.82 ms, TD = 500 ms for the slow flow and TD = 200 for the slow flow, MTC and Fatsat pulses were played for each partition, iPAT acceleration factor = 3. Total acquisition time is 2:45 minute for single station.



1A 1B 2A 2B

Figure 1. MIP images acquired with NATIVE SPACE angiography images at 1.5T: (A) acquired without MTC and fat saturation pulses, and (B) acquired with MTC and fat saturation pulses. Images with MTC and fat saturation pulses shows better background suppression and better overall image quality. **Figure 2.** MIP images acquired with NATIVE SPACE angiography of the same subject at 3T: (A) acquired without MTC and fat saturation pulses, and (B) acquired with MTC and fat saturation pulses which clearly show better background and veins suppression and better blood contrast.

Results and Discussion

As seen from the Figure 1 and 2, the MIP images acquired with NATIVE SPACE with magnetization transfer and fatsat pulses have better background suppressions and the better overall image quality of the vessels on both 1.5T and 3T systems. Stationary muscle and fat tissues are clearly seen on the MIP images acquired without MTC and fatsat pulses. The MTC pulse suppresses the muscle tissues and improves the blood contrast, and fatsat pulse suppresses the fat signal that result in better image subtraction for the MIP. At the 3T system especially, the difference on the images are clearly observed, as the background signal and fat signal are suppressed very well with the MTC and fatsat compares of those without the pulses. However, MTC and fatsat pulses may increase the SAR at the 3T system for any non-contrast angiography techniques. SPACE uses variable flip angle pulse that may help compensate the SAR problem, and therefore, NATIVE SPACE method is quite promising to use both MTC and fatsat pulses for better muscle and fat suppressions as well as improved blood contrast for non contrast angiography.

References

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