

3D FISP vs 3D Turbo FLASH for Contrast Enhanced MRA : Which One Is Better ?

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Purpose: At present, contrast enhanced MRA are performed using either 3D FISP or 3D FLASH techniques with very short TR and TE. In this study, we compared both techniques to investigate which method shows better performance. The comparisons were made at various imaging parameters and concentration of [Gd].

Materials and Method: The experiments were performed using 3D Turbo FLASH and 3D FISP sequences on a 1.5 T scanner (Magnetom Vision Plus, Siemens, Erlangen, Germany). The imaging parameters were TR/TE = 5.0/2.0 msec for 3D Turbo FLASH and TR/TE = 5.0/1.6 msec for 3D FISP. The flip angle was adjusted from 5° to 40°. The images were obtained at coronal plane with 4.0 mm effective slice thickness over 64 mm slab thickness. The matrix size and FOV were 96×256 and 300 mm for both sequences. The phantom consists of 40 centrifugal tubes, in which the different Gd concentrations, which ranged approximately from half dose (0.05 mmol/kg) to over 50 dose (5 mmol/kg), were prepared. Here, single dose is defined as 0.1 mmol/kg. The Gd-DTPA-BMA(Omniscan, Nycomed) was used for MR agent. The ROI was set inside each tube, which contains different concentration of Gd and signal-to-noise ratio(SNR) was evaluated and compared for performance test.

Results: 3D Turbo FLASH sequence showed higher SNR than 3D FISP in all flip angles except 1 5° and in all [Gd] concentration (from half dose to double dose). The maximum difference of SNR was observed at smallest flip angle (5°). At this flip angle, the SNR of 3D Turbo FLASH is approximately 5 times higher than that of 3D FISP for all [Gd] concentrations. Both 3D Turbo FLASH and 3D FISP showed flip angle dependence of SNR. The higher [Gd] concentration allowed larger flip angle, which is good for higher contrast-to-noise ratio (CNR) by means of better suppression of tissue signal. At large flip angle (30° -40°), the SNR of 3D Turbo FLASH is approximately 1.5 times higher than that of 3D FISP.

Conclusion: At various flip angles (from 5° to 40°) and various [Gd] concentration (from half dose to double dose), 3D Turbo FLASH revealed higher SNR than 3D FISP sequence. For further improvement of the quality of contrast enhanced MR angiogram, it is also suggested that the imaging parameter optimization is necessary. Otherwise, the better performance of 3D Turbo FLASH over 3D FISP would not be fully enjoyed.