Effects of Short Echo-Train-Spacing (ETS) in Non-Contrast MRA (Flow-Spoiled FBI) using half-Fourier FSE

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INTRODUCTION

Flow-spoiled FBI, a non-contrast enhanced peripheral MRA technique, has been developed and applications to clinical examinations have been reported in various diseases, such as arterial occlusion and venous malformation [1-3]. The technique allows acquisition of both systolic- and diastolic-triggered 3D half-Fourier FSE with ECG or peripheral pulse gating (PPG) in a single scan and providing arterial images and venous images, simultaneously. An effect of T2 blurring in half-Fourier FSE was introduced in the phase-encoding direction to depict pulmonary MRA [4]. In this study, an echo train spacing (ETS) of 3.5 ms in half-Fourier FSE with parallel imaging (SPEEDER) was compared with the ETS of 5.0 ms in peripheral MRA.

MATERIALS and METHODS

For designing a sequence with a 3.5-ms ETS half-Fourier FSE, a BW of 977 Hz/pixel was used, compared to the original sequence with the 5.0-ms ETS with BW of 651 Hz/pixel. For T2 blurring, a simulation was calculated using PSF with 3.5 ms and 5.0 ms. All experiment was performed on 5 healthy volunteers using a 1.5-T imager (EXCELART Vantage, Toshiba, Japan), with a 3.5-ms ETS and 5.0-ms ETS Flow-spoiled FBI sequence. Acquisition parameters are as follows; TR = 3RR intervals, TEeff = 77 ms (ETS = 3.5 ms) and 80 ms (ETS = 5.0 ms), matrix = 256x256, 22 slices with a 4-mm slice (interpolated to 44 slices with a 2-mm thick slice), FOV = 38x38 cm, and a total acquisition of 2:43. After acquisition, the width of arteries and veins were measured.

RESULTS and DISCUSSION

Table 1 shows the PFS result of arteries and veins using ETS of 3.5 ms and 5.0 ms. As reducing ETS, a full-width at half maximum (FWHM) becomes narrower. Since T2 of vein is shorter than that of artery, the blurring effect of vein is expected to be more or have a wider HWFM. The widths of artery and vein vessels in the 3.5-ms and 5.0-md ETS images are summarized in Table 2. As expected, short ETS of 3.5 ms gives a narrower width or less blur compared to the ETS of 5.0 ms. Figure 1 shows the calf MIP images of Flow-spoiled FBI using the ETS of 5.0 ms a) and 3.5 ms b). The 5.0-ms ETS image has considerable N/2 artifacts in the PE direction on peripheral images, whereas the 3.5-ms ETS image shows less artifacts. Because of the shorter ETS and a tighter RO gradient, coherence of echo components is maintained even in the presence of relatively fast flow. Therefore, less N/2 artifacts are observed. In addition, note that small branch vessels are depicted better in the 3.5-ms ETS compared to the 5.0-ms ETS.

CONCLUSION

A short ETS sequence allows less blurring in the Flow-spoiled FBI images and reduces the N/2 artifacts impressively. In addition, because of the less blurring, edges of arteries are ambiguously defined. However, further clinical evaluation is required.

REFERENCES

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	Artery(T2=220ms)	Vein(T2=120ms)
ETS=3.5ms(TE=77ms)	1.51pixel	2.23pixel
ETS=5ms(TE=80ms)	2.06pixel	3.99pixel

Table 1. Full-width at half Maximum (number of pixel) of PSF

	Artery	Vein
ETS=3.5ms(TE=77ms)	3.5pixel	5.5pixel
ETS=5ms(TE=80ms)	4.5pixel	6.0pixel

Table 2. Full-width at half Maximum (number of pixel) of a volunteer (knee)

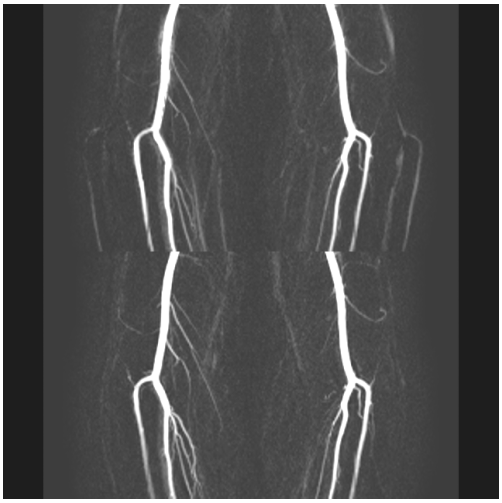

Figure 1. MIP images of calf using the ETS of 5.0 ms a) and 3.5 ms b)