2D Spiral MRDSA in the lower extremity and neck

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2D MRDSA can be implemented by using FGRE and spiral. Here we evaluated spiral MRDSA and FGRE MRDSA in the lower extremity and neck. After injection of a small dose(5ml) of gadolinium contrast agents, a 2D thick-slice dynamic Spiral or FGRE was scanned. Spiral had higher temporal and spatial resolution than FGRE, but spiral had decreased SNR. For carotid vessel, spiral image can show more small vessel detail than FGRE and spiral MRDSA can provide more detailed temporal information.

Introduction

2D MRDSA is a useful non-invasive method to estimate hemodynamics of vascular lesions in the low extremity and neck (1,2). It has been implemented by using fast spoiled gradient echo (FGRE) pulse sequences with 1-2 second temporal resolution. Spiral acquisition is more efficient than Catesian acquisition and thus can attain higher spatial resolution and it is optimal for sliding window reconstruction to achieve a temporal resolution = TR.

The purpose of this study was evaluate spiral MRDSA and FGRE MRDSA in the lower extremity and neck.

Methods

Nine healthy volunteers were studied for lower extremity(n=7) and neck(n=2). All experiments were performed on 1.5 MR scanner(GE Signa Cvi; maximum gradient strength,40mT/m; slew rate, 150mT/m/ms). Head coil was used for six lower extremity, extremity surface coil was used for one low extremity and antneck surface coil was used for the neck.

After injection of a small dose(5ml) of gadolinium contrast agents, a 2D thick-slice(30mm-50mm) coronal dynamic Spiral or FGRE was scanned. The scanning parameter for spiral and FGRE is given in table 1.

For spiral acquisition, two low-resolution single-shot spiral images, taken at different echo times, were used to compute a B0 field map. This map was then used for off-resonance correction(3)

Complex raw images continuously acquired after bolus contrast infusion are subtracted from the mask(4). Re-gridding, k-space density compensation, FFT, and off-resonance correction were then applied to spiral difference raw images and FFT applied to the FGRE difference raw images to generate angiograms in real space.

Results

Lower extremity: spiral had higher temporal and spatial resolution, but Spiral 2ddsa had about the half SNR to FGRE, so spiral image seems worse than FGRE image. When the extremity surface coil was used, the SNR was improved, but the spatial coverage was decreased (Fig. 1)

Carotid vessel: spiral image can show more small vessel detail than FGRE and spiral can provide more detailed temporal information .(Fig.2).

Conclusion

Spiral MRDSA can provide higher spatial and temporal information than FGRE.

Table 1. Imaging parameters for spiral and FGRE

PSD	TR (ms)	TE (ms)	FA	RBW (kHz)	X. RES	Y. RES	Rec. Max	Temp. RES.(s)
Spiral	14-18	1.2	60	125	2048	64	512	0.9-1.2
FGRE	8.3	1.8	60	15.6	256	256	256	2.1

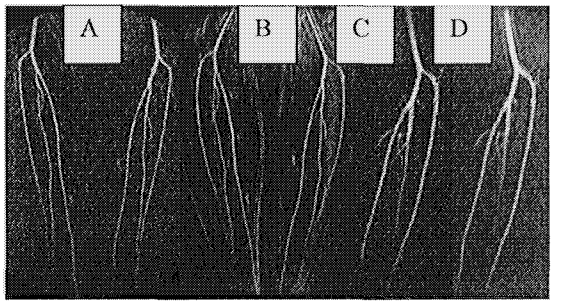

Fig. 1. MRDSA images from the lower extremity. Left images are obtained by using head coil: A)Spiral, B)FGRE. Right images are obtained by using extremity surface coil: C) spiral image, D)FGRE .

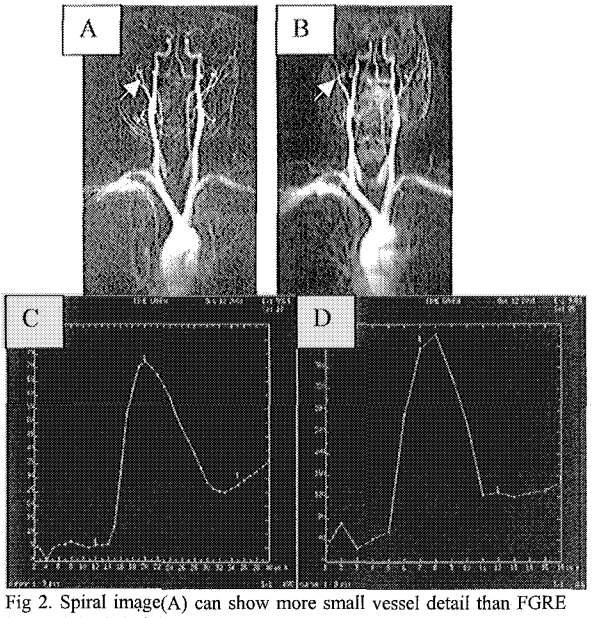

Fig 2. Spiral image(A) can show more small vessel detail than FGRE images(B). Spiral MRDSA(C) has higher temporal resolution than FGRE MRDSA(D).

References

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