Scout-less Stepping Table Whole-Body Contrast-Enhanced MR Angiography

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INTRODUCTION

Atherosclerosis commonly affects multiple portions of the circulatory system (1). Whole-body MRA has been applied previously to provide an overview of arterial disease throughout the body. One approach for whole body MRA is to use a multi-station acquisition during intravenous injection of a contrast agent. As with stepping table peripheral MRA, one needs to acquire scout images at each of the several table stations. The 3D imaging volumes must be carefully positioned on scout images to ensure that all the arteries are encompassed. Imperfect positioning may result in the false impression of a vessel stenosis or occlusion. For stepping table peripheral MRA, the process of acquiring scout images and positioning the 3D volumes takes approximately 70% of total exam time (2). Use of a scout-less imaging technique shortens and simplifies the acquisition procedure (3). The purpose of this study was to test whether a scout-less approach would also offer benefits for whole-body MRA.

MATERIALS AND METHODS

Six healthy volunteers were involved in this study. Two of the six volunteers were used for protocol optimization. The other 4 volunteers (3 men and 1 women, aged 40-43, average age of 41.5 years) with ranges of height (1.52 -1.90 m) and weight (67 -100 kg) were scanned with the optimized protocol. As for scout-less peripheral MRA (EZ-STEP) (3), spatially non-selective (hard) RF pulses were used to minimize TR and TE. A partial kz acquisition (70%) was incorporated for further speed up the acquisition. The whole-body MRA protocol includes four stations to span the arterial system from carotid arteries to the distal runoff vessels. The last station (calf level) was acquired twice. The coronal mask and angiogram were acquired sequentially at the 4 stations with FOV of 480 mm (50 mm overlap) and table speed of ~6 sec / 430 mm. In order to minimize venous contamination, reverse elliptical centric phase encoding order was applied in the first station. Elliptical centric phase encoding order was used in the other 3 stations. Zero-filled interpolation (ZIP2) was applied along the slice direction. MR studies were performed with the body coil on a GE Signa TwinSpeed 1.5 T scanner equipped with EXCITE technology. Since the FOV, position of each 3D volume, and table-shifts between stations were predetermined, no scout imaging or manual positioning of imaging volumes was needed. Predetermined pulse sequence parameters are summarized in **Table 1**. For each subject, 40 ml of gadopentetate dimeglumine (Magnevist, Berlex Laboratories, Wayne, NJ) was administered with a power injector (Medrad Spectris; Medrad, Indianola, PA). The first 18 ml of agent was injected at a rate of 2.0 ml/sec, then 22 ml at rate of 0.5 ml/second, followed by 15 ml saline at a rate of 0.5 ml/second. Fluoroscopic triggering was used to time the start of data acquisition for the first station (**Figure 1**).

Table 1
Predetermined parameters of 3D sequence for Whole body Angiography

	Slab thk. (mm)	Partition *(zip2)	Slice thk. (mm)	TR (ms)	TE (ms)	Flip Angle	BW (HZ)	FOV (cm)	Matrix	NEX	Scan time (sec)
Station 1	180.0	60*2	3.0/-1.5	2.0	0.6	25º	±125	48*38	256*160	1	~13
Station 2	192.0	64*2	3.0/-1.5	1.9	0.6	25º	±125	48*38	256*160	1	~13
Station 3	145.6	56*2	2.6/-1.3	1.9	0.6	25º	±125	48*38	256*160	1	~12
Station 4	139.2	58*2	2.4/-1.2	2.0	0.6	25º	±125	48*38	256*192	1	~15

BW = bandwidth.

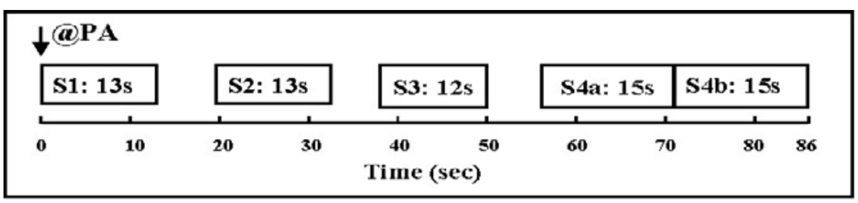

Figure 1. Graphic display of the acquisition time for each station in whole body angiography. ↓**@PA:** scan started when contrast was shown at the level of the pulmonary artery.

Figure 2. Coronal and lateral MRA images obtained with the scout-less approach

RESULTS

Whole-body MRA spanning the carotid arteries through the foot vessels was obtained with good image quality **(Fig. 2)** for all 4 subjects. Since the scout imaging and manual positioning of multiple imaging volumes were eliminated, scans for all 4 stations could be finished in about 7 minutes, including prescan (~2 min), mask (~1.5 min), angiogram (~1.5 min), time for passage of the contrast agent, and breath-hold instructions (~2 min).

CONCLUSION

The use of a scout-less whole-body MRA method significantly simplifies the exam procedure and makes the exam more efficient. It has the potential to prove useful for rapid evaluation of whole-body atherosclerotic burden.

REFERENCES

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