Whole Body Fresh Blood Imaging (FBI): Non-Contrast MRA from Head to Feet

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INTRODUCTION

Recently, whole body imaging gains tremendous interest, since observation of a whole-body image is clinically desired as a screening procedure. In general, a whole-body imaging with T1-weighted and STIR images are used to find the irregular mass or tumor [1,2]. In the cardiovascular examination, whole-body contrast-enhanced (CE) MRA techniques have been reported using multiple channel coils [3,4]. In a whole-body examination, multi-channel coil and parallel imaging are technically prerequisites to speed up the scan time. Since CE MRA has a help of signal from the contrast agents to depict the vessels of interest with a trade-off of signal reduction with the parallel imaging factors. To our knowledge, there is no report of whole-body non-contrast MRA. At 1.5T, the signal-to-noise (SNR) is a main concern of using a high parallel imaging factor with a multi-channel coil. A non-contrast MRA technique, fresh blood imaging (FBI), allows depiction of arteries and veins using ECG-triggering during diastole, where the flow is relatively slow [5]. In this study, we have investigated to depict whole-body vasculature trees using FBI, parallel imaging, and the Atlas SPEEDER coil with a total of 128 elements. In addition, the FBI study using a regular whole-body coil, not allowing parallel imaging, was performed to compare the depiction of vasculature trees.

MATERIALS and METHODS

All experiments were performed using a 1.5-T clinical imager (Toshiba, Vanatge, Tokyo, Japan), equipped with a total of 128-element coil (Atlas SPEEDER coil) on a 16-receiver system. Non-contrast FBI was performed with ECG-triggering during diastole to depict both arteries and veins in bright blood. Six separate stations were acquired to cover the head to feet using the following parameters; TR/TE=2RR/30 ms, ETS=5 ms, TI=190 ms, FA=90/180 degree, NAQ=2, FOV=55x40, 352x272, slice thickness=2 mm (interpolated to 1.0 mm), and the number of slices=60. For parallel imaging factor, 4.0(PE) x 2.0 (SE) was applied in the head part, 3.0(PE) x2.0(SE) was used in the chest, abdomen, iliac, and thigh stations. In the station at the calf region, parallel imaging reduction factor of 3.0(PE) was used. The phase-encode direction was oriented in the right-left direction in all 6 stations. To compare the signal intensity of vasculature trees on the Atlas SPEEDER images, a regular whole-body coil was used to acquire FBI images without parallel imaging.

RESULTS and DISCUSSION

Figure 1 shows a whole-body FBI images obtained using a whole-body coil (a) and the 128-element Atlas SPEEDER coil (b). Since the regular whole-body coil does not permit parallel imaging, image on the left shows vasculature trees with somewhat blurring, whereas, the Atlas SPEEDER coil provides less blurring in the FBI images due to a shorter acquisition window with increase in a parallel imaging reduction factor. Note that the pulmonary vasculature using the Atlas SPEEDER coil shows conspicuous depiction of pulmonary vessel branches, as compared to that obtained using a whole-body coil, as shown in Fig. 2. The FBI images (chest, abdomen, iliac and thigh regions) with a reduction factor of 8 provide conspicuous vessel depiction and sharper images without noticeable signal reduction of vasculature. For the brain region, FBI did not provide vascular structure, since T2 and T1 of brain parenchyma are similar to those of blood. The whole-body FBI with the Atlas SPEEDER coil is appropriate to apply in the screening procedure of MRA, since no contrast is required.

CONCLUSION

Increase number of parallel imaging factors allows improved vasculature trees using the non-contrast FBI technique. Non-contrast FBI examination using the Atlas SPEEDER coil provides a useful screening tool to study a whole-body MRA from head to feet.

REFERENCES

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Fig. 1 FBI images obtained using a general whole-body coil (left) and the Atlas SPEEDER coil (right).

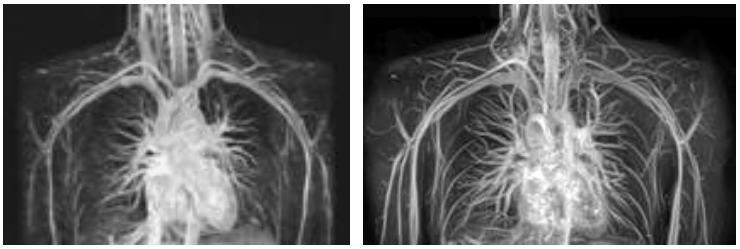

Fig. 2 Expanded images of Fig. 1. Note that pulmonary vessels are conspicuously depicted on the image (right) with the Atlas SPEEDER coil, as compared with the regular whole-body coil (left).