Adamkiewicz Artery using Non-Contrast Time-SLIP with 3D balanced SSFP

Y. yamashita[1], T. Yamamoto[2], S. Takemoto[2], A. Ninomiya[2], I. Aoki[2], and M. Yui[2]
[1]Toshiba Medical Systems Corporation, Tokyo, 26-5, Hongo 3-Chome, Bunkyo-ku, Japan, [2]Toshiba Medical Systems Corporation

INTRODUCTION

Adamkiewicz artery is an important artery to identify before the surgery of thoracoabdominal aortic disease or a stent graft placement in order to minimize a risk of postoperative spinal complications. There have been many reports concerning the identification of the Adamkiewicz artery using CE MRA and multislice CTA [1-3]. However, it is difficult of ensure the optimal timing of contrast enhancement, and a high level of experience and skill is required to successfully visualize the Adamkiewicz artery. A free-hand time-spatial labeling inversion pulse (time-SLIP) method with 3D half-Fourier FSE and 3D bSSFP allows marking or tagging the vessel of interest and observing the blood flowing into the imaging slices [4,5]. In this study, an intrinsic high contrast between blood and background of bSSFP was applied to depict the Adamkiewicz artery by suppressing the background with the time-SLIP pulse and depicting the inflowing blood into the imaging plane.

MATERIALS and METHODS

All experiments were performed using a 1.5-T clinical MR imaging system. Five healthy volunteers were examined using time-SLIP with 3D bSSFP and evaluated with various numbers of slices (2, 4, or 8) and different in-plane resolutions (0.6 to 1.2 mm, in 0.2-mm steps), slice thicknesses (1.0 to 1.6 mm, in 0.2-mm steps), and varied the inversion time (TI) values (750 to 1750 ms, with an increment of 250 ms). The assessment in depiction of the Adamkiewicz artery was performed visually with varying the above parameters. Typical imaging parameters were TR/TE = 8.4/4.2 ms, flip angle=120 deg, CHESS fat saturation, 2 segments, spatial resolution=0.6 mm, slice thickness=1 mm, and TI=1500 ms. The total scan time was about 5 min.

RESULTS and DISCUSSION

With an increase in in-plane resolution and a decrease in slice thickness, contrast between blood and background was improved due to a decrease in a partial volume effect; however, the vascular continuity becomes poor due to a decrease in signal-to-noise ratio (SNR). When the number of segments was increased, contrast between blood and background was improved and noticeable improvement in depiction of the Adamkiewicz artery was observed. This was thought that an inflow effect of the marked blood was enhanced. However, the number of segments can be increased with a trade-off of the scan time. A longer TI generally improved depiction of the Adamkiewicz artery; however, when a TI value of 1500 ms or higher was used, a significant signal recovery of cerebrospinal fluid (CSF) was observed, resulting in poor contrast. Figure 1 shows the Adamkiewicz artery images obtained on a volunteer. Since it was acquired on a healthy volunteer, no additional examinations was performed to identify this vessel as an Adamkiewicz artery. However, the continuation of the thin vessel is from the thoracic aorta run into the spinal artery, which was located between the Th-9 and Th-10. The Adamkiewicz artery is known to have variations in the location and branching positions from individual to individual. Therefore, further studies are required with consideration of physiological factors and individual characteristics as well as imaging parameters.

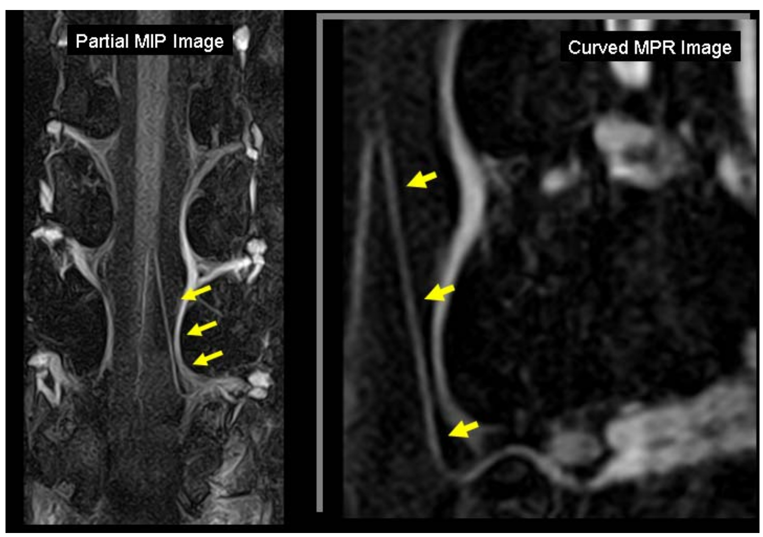

Fig. 1 Adamkiewicz artery images using time-SLIP 3D bSSFP (Left; partial MIP and Right: curved MPR). Note that hairpin curve of the Adamkiewicz artery is conspicuously visualized in the curved MPR image (see arrows).

CONCLUSION

Optimization of the time-SLIP 3D bSSFP technique was performed to depict the Adamkiewicz artery. Since our technique does not require any contrast materials, one can repeatedly study the Adamkiewicz artery. However, further clinical evaluation is required.

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