Non-invasive visualization of basilar artery wall and branches ostium with high-resolution 3D black blood sequence at 3.0T

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Introduction

2D black blood MR imaging has emerged as an effective tool to evaluate intracranial artery wall [1]. It has also been used to detect small branch occlusive disease at or near the origin of small branches and guide antithrombotic therapy [2]. However, it is limited due to small coverage and can not provide the whole information of the wall of curving course intracranial artery. The aim of the present study was to develop a High-resolution magnetic resonance imaging (HRMRI) method to image basilar artery (BA) wall and the ostia of the adjacent branch arteries.

Materials and Methods

We developed a 3D fast magnetic resonance black blood sequence flow-dephasing-prepared spoiled gradient recalled echo (FDP-FSPGR) sequence for BA wall and the ostia of the adjacent branch arteries at 3.0-T MRI (Twinspeed, GE Medical Systems) using an eight-channel head coil. 3D FDP-FSPGR images were acquired by a FDP-prepared segmented 3D FSPGR sequence (repetition time msec/echo time msec, 6.4/3.0ms; 160×160-mm field of view, 256×320 acquisition matrix; 2-mm section thickness; number of excitation, 4). FDP included two spin echoes to overcome the inhomogeneity of the radiofrequency field (Fig 1). The prep time of FDP was optimized to 23 msec to balance the blood suppression and the contrast between vessel wall and cerebral spinal fluid. Following FDP, chemical shift selective saturation was employed to suppress the fat signal. The total acquisition time is 239 sec. Ten patients with symptomatic atherosclerotic BA stenosis >50% were enrolled consecutively. Gadolinium-based contrast agent ((0.1 mmol/kg, Magnevist; Bayer Schering Pharma)) was administered to assess possible lesion enhancement in the patients.

Results

The walls of BA could be visualized in all patients with good contrast between wall, blood, and cerebrospinal fluid. A total number of 45 ostia of the adjacent branch arteries were identified including 18 superior cerebral arteries, 20 anterior inferior cerebral arteries, and 7 posterior inferior cerebral arteries. Eight of the ten patients showed BA plaque enhancement after contrast administration. Four of the 45 ostia have closely relationship with the enhanced plaque of BA (Fig 2).

Conclusions

Our data suggest that the sequence based on 3D FDP-FSPGR can be used for high-spatial-resolution and large coverage of the BA wall and the ostia of the adjacent branch arteries. 3D FDP-FSPGR sequence will make it possible to study the role of intracranial arterial wall pathology in ischemic stroke.

References

1. Ma N, et al. Neurology. 2010;75:253-8.
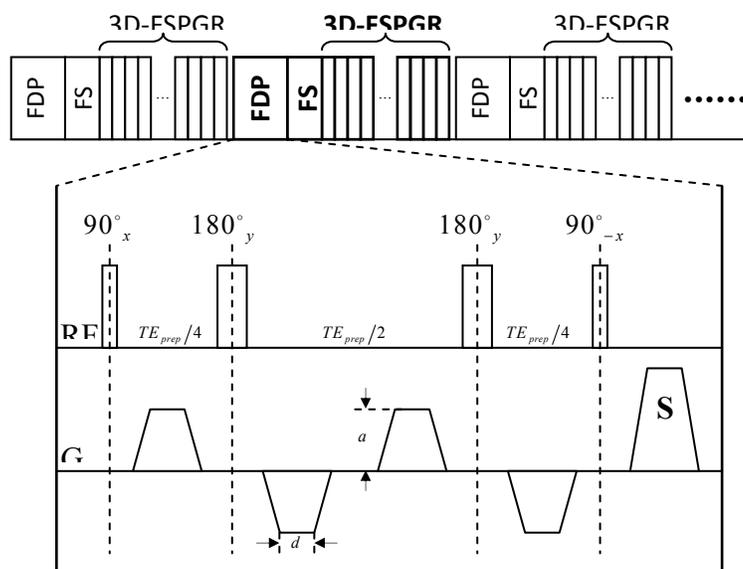2. Klein IF, et al. Stroke2010;41:1405-9..

Fig 1. Diagram of 3D FDP-FSPGR sequence.

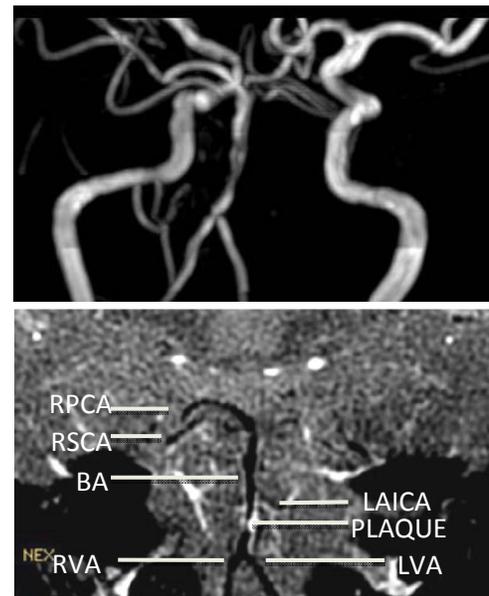**Fig 2.** A severe stenosis at the BA is shown on MRA in a 66-year-old man. Left AICA has closely relationship with enhanced plaque of BA on 3D FDP-FSPGR.