

Carotid plaque imaging with BLADE and SPACE

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INTRODUCTION: Double inversion recovery, dark blood imaging (DB) sequences with cardiac gating are considered as the gold standard for a plaque imaging. PROPELLER (periodically rotated overlapping parallel lines with enhanced reconstruction) is a self-navigating method for motion correction by repeated data acquisition of the center of k-space. BLADE is the Siemens implementation of PROPELLER technique. BLADE reduces motion artifact arising from physiological respiratory movement, arterial pulsation and swallowing. SPACE is based on 3D fast SE sequence with high turbo-factor over 200. 3D SPACE sequence exploits refocusing pulses with variable flip-angle for extremely short echo-spacing down to 3 ms and lower SAR. This study attempts to estimate clinical utilities of BLADE T2- and T1WI, and 3D SPACE T1WI for the detection and evaluation of carotid plaques.

MATERIALS AND METHODS: All patients were examined at 1.5-T and 3-T (MAGNETOM Avanto and Trio, A Tim Siemens) using 4-channel neck matrix coil. DB T2WI parameters were as follows: 2 R-R/82ms/17 (TR/TE/ETL); FOV, 16 cm; matrix size, 320; axial sections, 4 mm thick; and scan time, 2 m 30 s. BLADE T2WI parameters: 3000/78ms/11; FOV, 16 cm; matrix size, 256; axial sections, 4 mm and scan time, 3 m 5 s. BLAD DB T2WI; 2 R-R/78ms/17; FOV, 16 cm; matrix size, 256; axial sections, 4mm and scan time, 2 m 30 s. 3D SPACE parameters; 650/20ms/200; FOV, 26 cm; matrix size, 324; sections, 0.7 mm and scan time 4 min 23 sec. 33 patients with cerebral ischemic events were examined.

RESULTS: Multi-slice BLADE sequences and SPACE T1WI detected all carotid plaques. No pseudonegative cases were identified. BLADE showed excellent image quality without significant artifacts; however, BLADE tended to overestimate the evidence and the size of plaque in 26%, because BLADE corrected slow turbulent flow close to carotid wall. The overall image quality of BLADE-DB T2WI was rated higher in 65% compared with DB sequences (fig.1). SPACE T1WI showed the extent of lipid-rich plaques on continuous vessel tree images by curved MIP (fig.2).

CONCLUSIONS: BLADE sequences without cardiac gating are feasible for detecting not only atherosclerotic plaque but also the neighboring turbulent flow, which is a risk factor of the intimal injury. 3D SPACE provides continuous vessel tree images with curved MIP. Multi-slice BLADE sequences and 3D SPACE are useful methods and the initial sequences of choice for screening of carotid plaque and its risk factor, because those can cover the entire carotid bifurcation without cardiac gating during the same acquisition time as single-slice DB imaging. BLADE DB sequences with cardiac gating are the best-preferred methods for precise evaluation of anatomical details and plaque contents. When multi-slice BLADE or SPACE show positive findings, single-slice BLADE-DB sequences with cardiac gating should be added to access cardiac plaque in detail.

Fig.1A DB T2WI

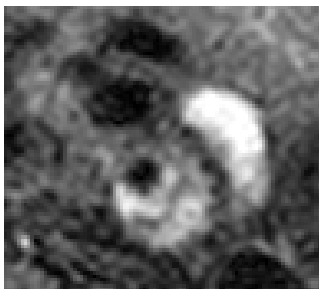


Fig 1B BLADE-DB T2WI

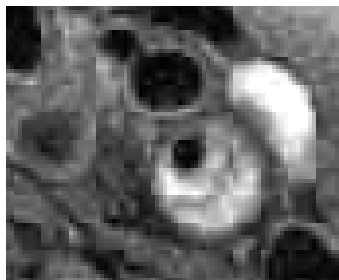


Fig.2 3D SPACE

