The detection of the stenotic lesion in proximal internal carotid artery using black blood imaging with CUBE T1 in comparison of MRA with 3D TOF.

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Target Audience: The scientists, physicians, and technologists who are interested in black blood imaging for cerebrovascular diseases.

Introduction: 3D time of flight (TOF) technique have been widely used as one of the standard techniques for Non-contrast enhanced MRA in the brain and is also used for neck arteries. An investigational version of fat-suppressed 3D FSE T1WI (CUBE T1), with large neck and head coverage, acceptable scan duration and black blood(BB) effect might be useful in assessment of stenotic lesion. The purpose of this study was to evaluate the detection of the stenotic lesion in proximal internal carotid artery (ICA) using BB imaging with CUBE T1 in comparison of MRA with 3D TOF.

Materials and methods: This study was approved by the institutional review board in our hospital.

Patients: From November 2012 to April 2013, thirty seven patients who underwent MR imaging on a 3T magnet or a 1.5T magnet for the evaluation of the neck arteries were included (30 males, average age = 69y, range 33 – 94y). Informed consent was obtained from all the patients. *MR imaging:* A 3T MR magnet (Discovery MR750, GEHC) or a 1.5T MR magnet (Signa HDxt) were used with phased array head and neck coil. All patients underwent head and neck MR imaging including CUBE T1 and 3D TOF techniques as follows; 1) CUBE T1 was performed in a coronal plane covering from the aortic arch to the circle of Willis with using fat-suppressed 3D FSE technique (TR/TE, 500/17; flip angle, 90°; ST = 1mm; acquisition time, about 3.5 minutes)(Fig.1). 2) 3D TOF was performed in an axial plane in the coverage of cervical common carotid artery (CCA) and carotid bifurcation (24/3.1; 20°; 1.6mm; 2.5 minutes). *Assessment:* The diameter of CCA just below the carotid bifurcation was measured on BB imaging with CUBE T1 and MRA with 3D TOF. The degree of the ICA stenosis was evaluated by 1) the NASCET criteria on both BB imaging with CUBE T1 (BB-N) and MRA with 3D TOF (TOF-N) ; 2) the ECST criteria on BB imaging with CUBE T1 (BB-E), using their source images, maximal intensity projection images, and multiplannar reformation images.

Results: Good BB effect was obtained on CUBE T1 in all patients. The diameter of the CCA was matched well between BB imaging with CUBE T1 and MRA with 3D TOF (Result 1). BB-N, BB-E and TOF-N showed a good correlation either (Result 2). In particular, 17 vessels that exhibit stenosis of more than 50% on TOF-N were found as stenosis of more than 50% on both BB-N and BB-E, too. Although 57 vessels exhibit stenosis of less than 50% on both TOF-N and BB-N, 13 vessels of them were found as stenosis of more than 50%.
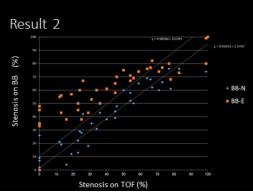
Discussion: In the early stage of atherosclerotic lesions, the positive remodeling precedes than the stenosis of the vessel lumen[1]. Bright blood imaging like MRA with 3D TOF which evaluates mainly the lumen of the vessel was thought difficult to detect the early lesions, BB imaging acquired the information of the vessel wall might be useful to detect them. BB imaging with CUBE T1 can be useful as screening technique because of the large coverage and acceptable scan duration.

Conclusion: BB imaging with CUBE T1 can be useful to detect the ICA stenosis and atherosclerotic lesions.

Reference: 1.Morteza Naghavi et al,Circulation.2003;108:1664-1672