Contrast-Enhanced 3D Brain Black-Blood Imaging for Detection of Intracranial Arterial Unstable Plaque in Acute Ischemic Stroke Patients

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Introduction

Recent several investigators report the plaque enhancement may represent an unstable plaque and unstable plaques may be more likely to lead to cerebral infarction (1). To evaluate arterial wall or plaque, black-blood imaging is mandatory. The 3D fast spin echo sequence optimized for T1-weighted contrast is introduced for the selective suppression of the signal intensity of blood (2). We evaluate the pattern of enhancement presumed unstable plaque and arterial wall imaging in the intracranial artery of patients with recent symptomatic infarction.

Material & Methods

Eighteen patients (mean age 71 years, woman 10) having acute infarcted diffusion lesion in the territory of the affected artery were enrolled. Six patients with significant ($\geq$ 50%) and twelve patients with non-significant ($<$ 50%) intracranial stenosis based on a preceding TOF-MRA were recruited. All patients underwent pre- and post-contrast 3D brain black-blood vessel wall imaging. Imaging was performed at 3T (Magnetom Verio, Siemens Medical Solutions, Erlangen, Germany) with 32-channel head coil. Imaging parameters for the 3D single slab fast SE black-blood sequence were: TR/ TE, 620/23-24ms, ETL 23, ESP, 3-5ms, thickness 1-2mm, Matrix 448 x 480, NEX 2. Vessel wall images were evaluated by visual inspection for enhancement of atherosclerotic plaque. The presence of enhancement was assessed qualitatively by an experienced observer through comparison of the T1 images before and after gadolinium administration.

Results

Of these 18 patients, 15 had focal or diffuse eccentric wall enhancement in the intracranial artery supplying the territory of acute infarct. One patient had mild thickened vessel wall without enhancement. Two patients had no thickened vessel wall and enhancement. In the non-significant stenotic group (n=12), 6 patients had no stenosis in TOF-MRA. Of these 6 patients, 3 patients had eccentric vessel wall thickening and enhancement and one patient had just thickened vessel wall.

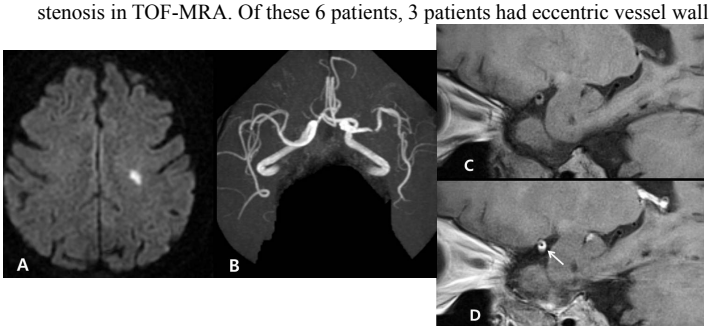

Figure 1. DWI image (A) shows an acute lacunar like infarcted lesion at the left centrum semiovle. TOF-MRA (B) shows significant stenosis at the left MCA M1. Precontrast 3D Black-Blood image (C) reveals diffuse thickened vessel wall. Postcontrast 3D Black-Blood image (D) visualizes diffuse eccentric vessel wall enhancement(arrow).

Figure 2. DWI image (A) shows an acute infarcted lesion at the right basis pontis.. TOF-MRA (B) shows no evidence of stenosis at the basilar artery. Precontrast 3D Black-Blood image (C) reveals no atherosclerotic change at the basilar artery. Postcontrast 3D Black-Blood image (D) visualizes mild eccentric vessel wall enhancement at the right mid-basilar artery.

Discussion

Contrast-enhanced 3D fast spin echo black-blood images at the 3 T may be able to differentiate enhancement patterns of intracranial atherosclerotic plaques (eccentric), especially in the non-significant intracranial artery stenosis patients. High-resolution 3D black-blood images could help precise stroke subtyping.

References *(1) Vergouwen MD, et al. Arch Neurol 2011; 68:338 (2) Park J, et al.MRM 2007; 58:982*